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1. EDT 142075

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16. KEY

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7. Abstract

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SUMMARY

The Pacific Northwest Laboratory (PNL) conducted slug tests in 10 wells adjacent to single-shell tanks in the 200 Areas for Westinghouse Hanford Company. Data from the tests were analyzed to determine best estimates for equivalent hydraulic conductivities and corresponding transmissivities. All of the wells tested were open to the uppermost part of the unconfined aquifer, ~~but~~ well 299-E33-33 was open to the Hanford formation; wells 299-E24-19, 299-E25-40, 299-E25-41, 299-E27-13, 299-E27-14, and 299-E27-15 were open to the undifferentiated Hanford/Ringold Formation; and wells 299-W10-15 and 299-W10-16 were open to the Ringold Formation. Data from well 299-E27-12 could not be analyzed.

The best estimate of equivalent hydraulic conductivity of the test interval at well 299-E33-33 is 320 ft/d. The corresponding transmissivity of the test interval at this well is 5400 ft^2/d. The best estimates of equivalent hydraulic conductivity of the test interval at wells 299-E24-19, 299-E25-40, 299-E25-41, 299-E27-13, 299-E27-14, and 299-E27-15 range from 24 to 390 ft/d. Corresponding transmissivities of the test interval at these six wells range from 330 to 5600 ft^2/d. The best estimate of equivalent hydraulic conductivity of the test interval at wells 299-W10-15 and 299-W10-16 is 33 ft/d. Corresponding transmissivities of the test interval at these two wells range from 530 to 540 ft^2/d. Estimates of equivalent hydraulic conductivity and transmissivity could not be determined for well 299-E27-12. A summary of the best estimates for transmissivity and equivalent hydraulic conductivity is presented in Table S.1.

Some of the assumptions required by the methods used to analyze the slug test data were not fully met. The rapid water-level response observed in most of the 200-East Area tests, where the aquifer is highly permeable, may have introduced turbulent flow conditions. The analytical results determined from these tests must, therefore, be used with some caution because the assumption inherent in the analytical method requires laminar (Darcian) flow conditions. Other assumptions violated that may have influenced the

TABLE S.1. Summary of Best Estimates of Transmissivity and Equivalent Hydraulic Conductivity for Wells Near the Single-Shell Tanks in the 200 Areas

Well Name	Area	Analysis Method	Transmissivity,[a] ft^2/d	Equivalent Hydraulic Conductivity, ft/d
299-E24-19	200-East	Bouwer and Rice (1976)	1700	110
299-E25-40	200-East	Bouwer and Rice (1976)	1100	70
299-E25-41	200-East	Bouwer and Rice (1976)	330	24
299-E27-12	200-East	Data Not Analyzable	-	-
299-E27-13	200-East	Bouwer and Rice (1976)	2500	180
299-E27-14	200-East	Bouwer and Rice (1976)	2600	160
299-E27-15	200-East	Bouwer and Rice (1976)	5600	390
299-E33-33	200-East	Bouwer and Rice (1976)	5400	320
299-W10-15	200-West	Bouwer and Rice (1976)	530	33
299-W10-16	200-West	Bouwer and Rice (1976)	540	33

(a) Transmissivity was calculated by multiplying equivalent hydraulic conductivity by the thickness of the test interval, which varied slightly from well to well.

analytical results from all tests conducted include the assumptions that require a fully developed well and an instantaneous initial water-level change.

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1.0 INTRODUCTION

Hydrologic tests were conducted in 10 of the 12 newly drilled wells near single-shell tank farms in the 200 Areas between September and November 1989. The wells were designed to monitor ground water beneath these tank farms as required by the Resource Conservation and Recovery Act (RCRA). The Pacific Northwest Laboratory[a] conducted the tests as part of a larger RCRA drilling effort funded by Westinghouse Hanford Company. The tests are considered "opportunistic" in that the wells were not designed specifically for aquifer testing for the given aquifer conditions. However, the hydraulic property estimates derived from the tests can be used, provided the assumptions required in the analytical solution are not significantly violated.

The purpose of the hydrologic tests was to provide estimates of transmissivity and hydraulic conductivity of the uppermost part of the unconfined aquifer. Estimates of transmissivity and hydraulic conductivity were determined from 9 of the 10 wells tested. (The 10 wells tested are listed in Table 1.1.) Estimates could not be determined from slug tests performed in 1 of the 10 wells, well 299-E27-12 in the 200-East Area. In addition, slug testing was not performed in wells 299-E33-31 and 299-E33-32, also in the 200-East Area. These 2 wells, with the 10 that were tested, compose the 12 newly drilled wells. The locations of the wells tested are shown in Figures 1.1 through 1.4.

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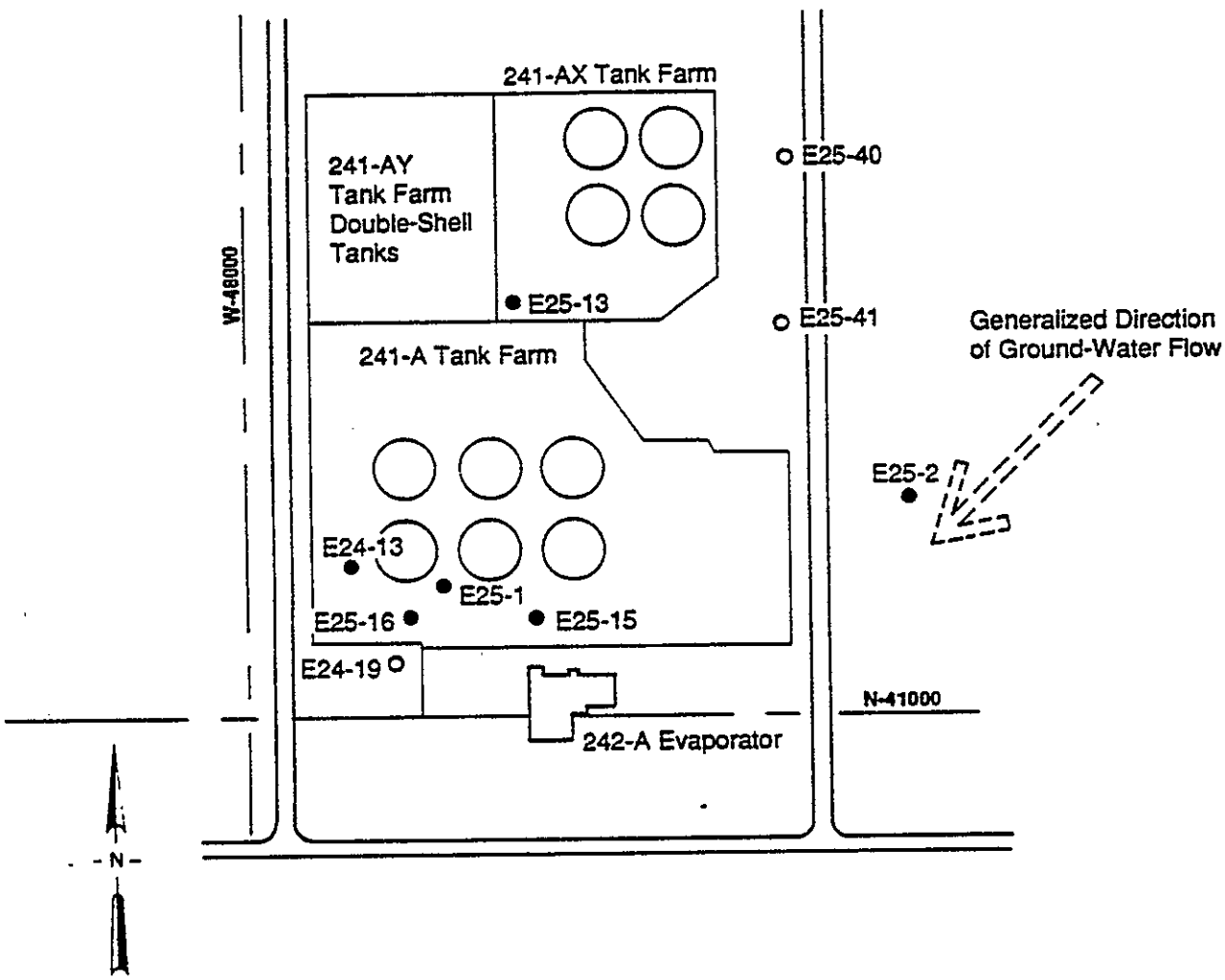
TABLE 1.1. Wells in Which Slug Tests Were Conducted

200-East Area	200-West Area
299-E24-19	299-W10-15
299-E25-40	299-W10-16
299-E25-41	
299-E27-12	
299-E27-14	
299-E27-15	
299-E33-33	

(a) The Pacific Northwest Laboratory is operated for the U.S. Department of Energy by Battelle Memorial Institute under Contract DE-AC06-76RLO 1830.

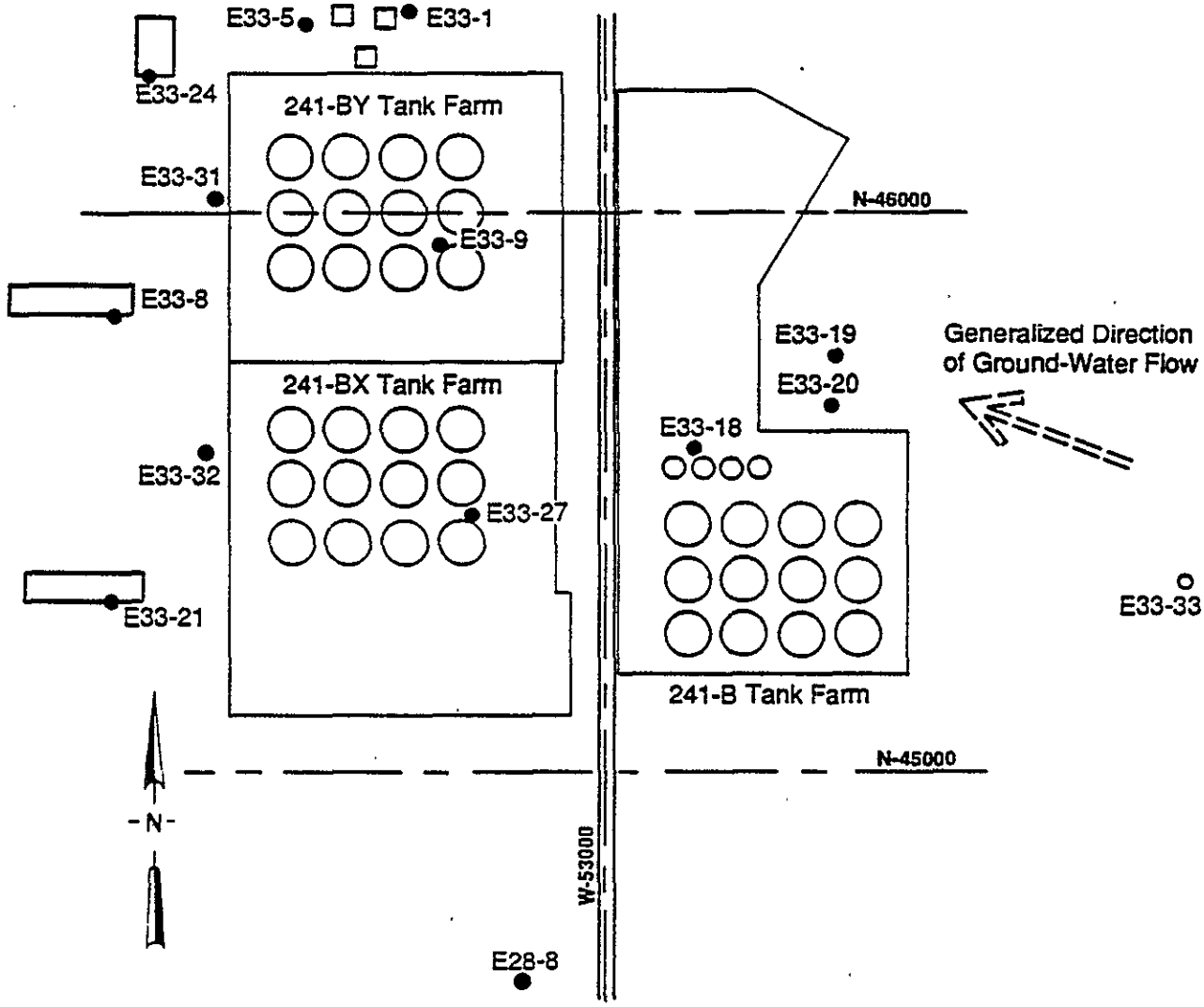


Legend

- ○ Monitoring Well Used for Slug Tests
- ● Additional Ground-Water Monitoring Well
- E25-1 Numbering System for Ground-Water Monitoring Wells. All Wells Prefixed by 299-
- ◯ 100 Series Single-Shell Tank
- —— Fences
- ═══ Roads
- ▭ Cribs
- N-42000 Hanford Plant Coordinates

Note: Not Drawn to Scale

FIGURE 1.1. Locations of Wells Near Waste Management Area A-AX in the 200-East Area



Legend

- Monitoring Well Used for Slug Tests
- Additional Ground-Water Monitoring Well
- E25-1 Numbering System for Ground-Water Monitoring Wells. All Wells Prefixed by 299-
- 200 Series Single-Shell Tank
- 100 Series Single-Shell Tank
- Fences
- Roads
- Cribs
- N-42000 Hanford Plant Coordinates

Note: Not Drawn to Scale

FIGURE 1.2. Locations of Wells Near Waste Management Area B-BX-BY in the 200-East Area

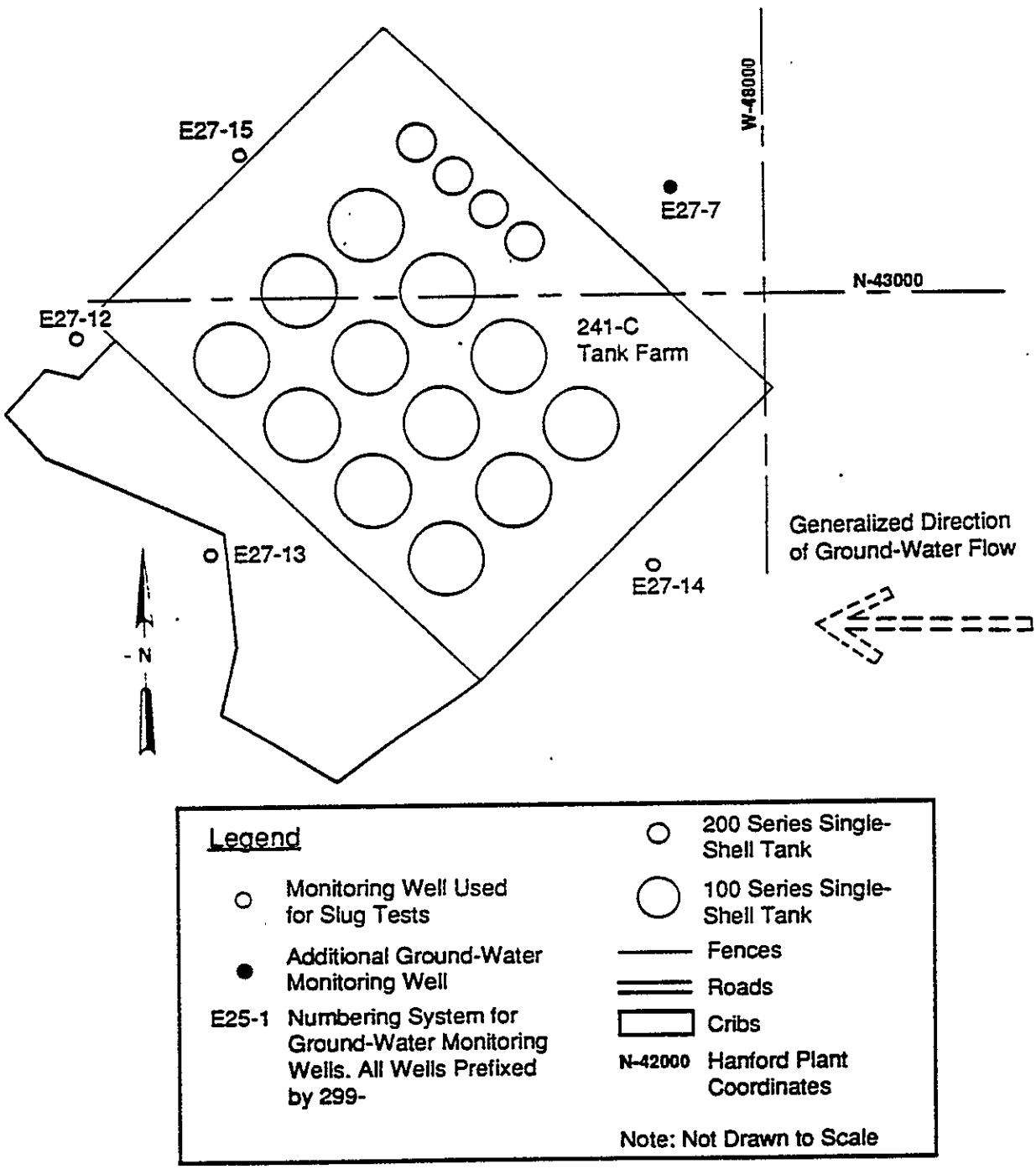
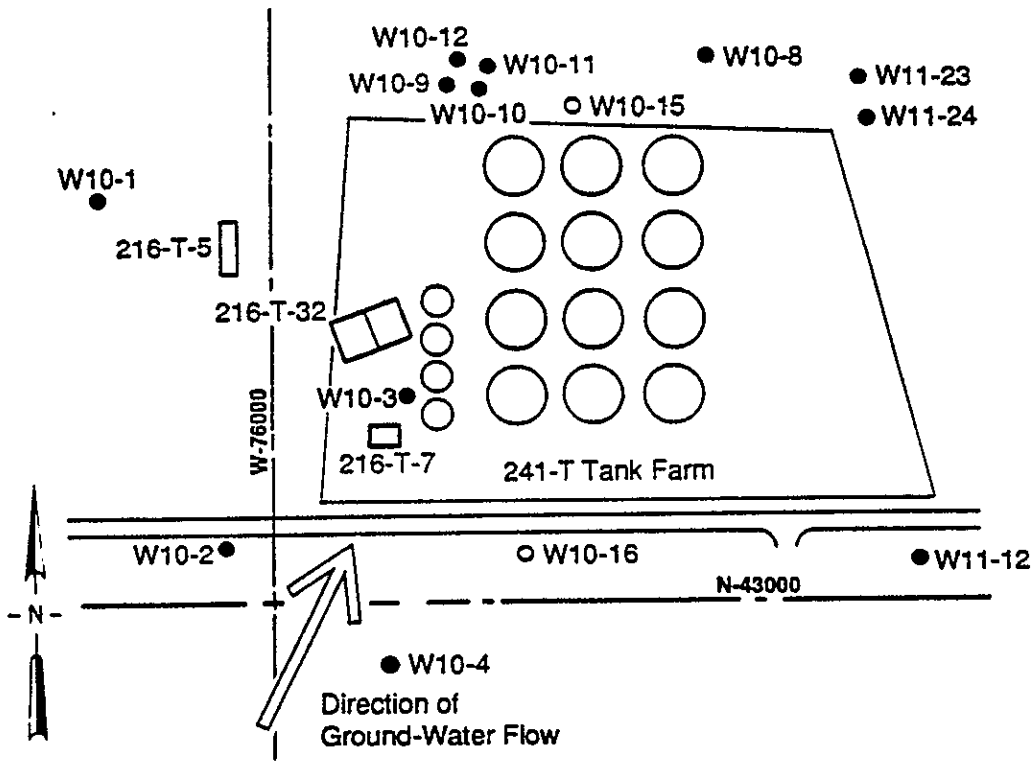


FIGURE 1.3. Locations of Wells Near Waste Management Area C in the 200-East Area



Legend

- ○ Monitoring Well Used for Slug Tests
- ● Additional Ground-Water Monitoring Well
- E25-1 Numbering System for Ground-Water Monitoring Wells. All Wells Prefixed by 299-
- ○ 200 Series Single-Shell Tank
- ◯ 100 Series Single-Shell Tank
- ——— Fences
- ═══ Roads
- ▭ Cribs
- N-42000 Hanford Plant Coordinates

Note: Not Drawn to Scale

FIGURE 1.4. Locations of Wells Near Waste Management Area T in the 200-West Area

Hydrologic testing was limited to slug tests because it eliminates the need to purge large volumes of water, which must be contained for chemical sample analyses prior to proper disposal.

This report discusses the field equipment used to conduct the tests and the methods used to analyze the test data. The test results are then evaluated and calculated estimates presented.

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2.0 FIELD EQUIPMENT USED

Slug tests were conducted by quickly raising or lowering a slugging rod in the well to displace the water column and recording the water-level response with a pressure transducer data-logger system. The procedure (AT-6) that describes this technique is discussed in detail in PNL (1989). The description of the field equipment is provided below.

SLUGGING ROD

Two sizes of slugging rods were used in conducting the slug tests, one 6 ft in length and one 8 ft in length. The diameter of the 6-ft rod was 0.19 ft (2-1/4 in.), and the diameter of the 8-ft rod was 0.24 ft (2-7/8 in.). Dimensions of each rod are presented in Table 2.1, with the theoretical maximum change in water level the rods will cause in a 4-in.-inside-diameter well. Each slugging rod consisted of a carbon steel pipe, which was partially filled with sand and sealed at both ends. A rebar hook was welded to the top to allow attachment of a wire-line cable. A Kaiser Engineers Hanford's (KEH) pump-setting rig was used to raise and lower the slugging rod for each slug test.

FIELD INSTRUMENTATION

The water-level changes during the slug tests were measured and recorded with a 10-psi pressure transducer data-logger system. The transducer was lowered to the bottom of the well and connected with a cable to a data logger at the surface. The data logger recorded the water-level changes at the manufacturer's preset time intervals, which approximated a logarithmic scale.

TABLE 2.1. Slugging Rods Dimensions, Volumes, and Theoretical Displacement

Rod Size	Length, ft	Diameter, ft	Volume, ft^3	Theoretical Water-Level Displacement in 4-in.-dia Well, ft
6-ft rod	6.00	0.19	0.17	1.90
8-ft rod	8.05	0.24	0.36	4.17

The schedule of the preset time intervals for all the tests conducted are shown in Table 2.2. The reference water level for each test was the equilibrated water level measured in the well before the test. A sequential test number displayed by the data logger to be in the range 0 to 9 was assigned to each test to identify it from other tests conducted at the same well. The test number was incremented by one to the next higher number before conducting the next test. The first test for each well does not necessarily begin with 0. The test number for each test is shown in the data output in the Appendixes.

LIMITATIONS OF EQUIPMENT

The existing well design and test equipment presented a number of limitations to the performance of the slug tests and analysis of the data. These limitations included

- a maximum possible water-level change of 4.17 ft with the 8-ft slug and 1.90 ft with the 6-ft slug
- possible erroneous water-level measurements because of transducer movement during introduction or removal of the slugging rod
- data acquisition limitations associated with the pressure transducer data-logger systems (e.g., determining the initial water-level change and the time of test initiation accurately).

TABLE 2.2. Schedule of the Time-Interval Sequence for Data Collection

Cycle	Elapsed Time	Time Interval
1	0-2 sec	0.2 sec
2	2-20 sec	1 sec
3	20-120 sec	5 sec
4	2-10 min	30 sec
5	10-100 min	2 min

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3.0 METHODS OF ANALYSIS

The Bouwer and Rice (1976) and Cooper et al. (1967) methods were used to analyze aquifer slug test data. An update to the Bouwer and Rice method was published by Bouwer (1989). These methods are discussed below.

BOUWER AND RICE METHOD

The Bouwer and Rice method (Bouwer and Rice 1976) was designed to estimate the hydraulic conductivity of an unconfined aquifer in the close vicinity of the borehole. This method can be applied to slug tests conducted in the screened or open portion of wells that partially or fully penetrate the aquifer. This method can also be used to estimate hydraulic conductivity of confined, semiconfined, or stratified aquifers (Bouwer 1989).

The following are important assumptions in applying the Bouwer and Rice method:

- The aquifer is homogeneous and isotropic.
- Drawdown of the water table near the well is negligible.
- Head losses as water enters the well (well losses) are negligible.
- The well is fully developed.
- The initial change in water level is instantaneous.
- Flow in the capillary fringe is ignored.

One of the well geometry parameters used in the Bouwer and Rice calculations is the casing radius, r_c. If the water-level fall or rise occurs within the casing, the actual radius of the casing is used for this value. If the water-level rise or fall occurs in the screened interval of the well, the casing radius must be corrected for the thickness and porosity of the filter pack. The water-level changes for all the tested wells discussed in this report occurred within the screened interval. The equation to correct for the radius, r_c, as presented in Bouwer (1989) is

$$r_c = [r_s^2 + p(r_f^2 - r_s^2)]^{1/2} \quad (1)$$

where r_s is the radius of the well screen in feet, p is the estimated porosity of the filter pack, and r_f is the radius of the well screen and filter pack in feet.

The Bouwer and Rice analytical equation used to calculate the hydraulic conductivity, K, between the limits Y_o, the intercept, at t = 0 and Y_t at t on a semilogarithmic plot of the water-level change (Y_t) versus time (t) is

$$K = \frac{r_c^2 \ln (R_e/r_w)}{2 L_e} \frac{1}{t} \ln \frac{Y_o}{Y_t} \qquad (2)$$

where r_c = corrected radius of the screened interval, ft

R_e = effective radius equivalent to the radial distance over which the head loss is dissipated in the flow system, ft

r_w = radial distance between the well center and the undisturbed aquifer, ft

L_e = length of the tested (screened) interval, ft.

The term R_e, expressed as $\ln(R_e/r_w)$, is a function of the well and aquifer geometry and is evaluated from results of an analog analysis performed by Bouwer and Rice (1976). The form of the equation to calculate this term, including the determination of dimensionless parameters used in this equation, is presented in Bouwer (1989).

During slug withdrawal tests, anomalies are sometimes observed in the early portion of the rate of water-level recovery. These anomalies, referred to as the "double straight line effect," are due to drainage of a filter pack or developed zone around the well screen after the water level is lowered (Bouwer 1989). The early data can be ignored and the second straight line, which is more representative of the undisturbed aquifer, can be used for calculating the hydraulic conductivity.

COOPER ET AL. METHOD

The Cooper et al. method (1967) was designed to estimate the transmissivity of a confined aquifer in the close vicinity of a borehole. The method involves fitting a semilogarithmic plot of change in head (H) divided by the initial change in head (H_0) versus time to one of a set of type curves established for an instantaneous water-level change in a well of finite diameter. Additional type curves for the analysis of test data were generated by Papadopolus et al. (1973).

Important assumptions in applying the Cooper et al. method, in addition to those assumptions stated previously for the Bouwer and Rice method, are 1) the well is screened (or open) throughout the full thickness of the aquifer, and 2) confined aquifer conditions exist.

The Cooper et al. method may be used to analyze tests conducted in wells that partially penetrate an aquifer, provided that flow is essentially two-dimensional (i.e., essentially no vertical flow) within the stressed zone of the aquifer during the test. The determined value of transmissivity from tests conducted in wells that partially penetrate the aquifer represents the stressed (saturated screen) interval (Cooper et al. 1967). This method may also be applied to tests exhibiting unconfined aquifer conditions provided that the saturated thickness is uniform (Walter and Thompson 1982).

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MAJOR LIMITATIONS

One limitation to analyzing the test data is that turbulence may have been present during the earliest portion of the test. Data from most of the 200-East Area slug tests indicate that the water-level response as a result of injecting or withdrawing the slugging rod was extremely rapid. The length of time for the water level to return to its pretest level was on the order of 10 sec or less. This rapid response may introduce turbulent flow inside the well, particularly during the early part of the test. Turbulence may cause errors in data collection by the pressure-measuring instrument. Methods commonly used to analyze slug test data assume Darcian (laminar) flow.

Turbulence within a pipe occurs at a Reynolds number of 2000 or greater (Roberson and Crowe 1985). The equation that relates Reynolds number to velocity is

$$Re = VD/\mu \quad (3)$$

where Re = Reynolds number

V = velocity, ft/sec

D = pipe diameter, ft

μ = kinematic viscosity of water, ft^2/sec.

To determine when turbulent flow conditions exist, estimates for the parameters were used to solve for Equation (3). The value reported for kinematic viscosity of water at 50°F is 1.41E-5 ft^2/sec (Roberson and Crowe 1985). The inside well-screen diameter for all wells tested is 4 in. Substituting these values into Equation (3) and rearranging yields a velocity of 8.46E-2 ft/sec.

Velocity of flow exceeded 8.46E-2 ft/sec during the earliest part of all the tests (e.g., 0 to 2 sec). This velocity indicates that turbulent flow conditions may have existed during the earliest part of the tests before giving way to laminar flow conditions during the latter part of the tests. This change may be particularly true for most of those tests conducted in the 200-East Area, where the stress-induced water level responded rapidly because of high permeability in aquifer conditions. The analytical results determined from tests conducted under these conditions must, therefore, be used with some caution.

The entrance velocity must also be calculated to determine the presence of head losses associated with turbulent flow through the screen during the early part of the test. Head losses generally occur if the entrance velocity through the screen exceeds 0.1 ft/sec. The entrance velocity can be determined by dividing the total open area of the test interval into the volume of water entering the well per unit time.

The data from slug withdrawal test #2 at well 299-E33-33 was used to calculate the entrance velocity. The open area of 28.5 $in.^2/ft$ (the open area of the inner and outer screen according to Johnson Filtration Systems, Inc.) multiplied by the length of the test interval ("saturated" screen interval) of 17.0 ft equals a total open area of 3.36 ft^2. The volume of water that entered the well between 0.0133 min (0.8 sec) and 0.0333 min (2 sec) after the data logger was initiated, during which the water level rose 0.78 ft, was calculated to be 0.068 ft^3. This volume divided by the increment of time associated with the change in water level equals the flow rate, or 0.057 ft^3/sec. This value divided by the total open area of 3.36 ft^2 equals 0.017 ft/sec, the entrance velocity of water through the screen during the early part of the test. This value of entrance velocity does not exceed the value of 0.1 ft/sec. Therefore, head losses associated with flow through the screen immediately following the imposed stress were negligible. Head losses were, therefore, negligible in the other wells in which tests were conducted because the water-level response during test #2 in well 299-E33-33 equilibrated more quickly than did the water-level responses observed during the tests conducted in the other wells.

Another limitation in analyzing the test data is erroneous water-level changes observed at the beginning of some of the tests. Water-level fluctuations were observed at the beginning of some of the tests in which some of the recorded values exceeded the theoretical water-level displacement expected, calculated using the dimensions of the slugging rods. This excessive displacement indicates that these fluctuations may be a result of erroneous water-level measurements caused by a fluid column of air and water created when the slugging rod was removed from the water. Also, these fluctuations may possibly be caused by induced inertial effects.

Another important limitation in analyzing the test data is that all the wells were not developed before conducting the slug tests. Because the wells were not developed, the calculated values of transmissivity and hydraulic conductivity may be biased. In an undeveloped well, aquifer materials adjacent to the borehole may be disturbed as a result of the drilling technique

used. The hard-tool drilling technique may introduce fines into the aquifer adjacent to the borehole thereby causing a zone of reduced or "altered" formation hydraulic conductivity.

For slug injection tests, the equilibrium water level was below the top of the screen. A sudden rise in the water level will induce flow not only into the aquifer, but also through the vadose zone above the water table. Flow through the vadose zone increases the rate of water-level decline and, hence, leads to an overestimation of transmissivity and hydraulic conductivity for the slug injection tests (Bouwer 1989). Therefore, for this well configuration, slug injection tests are less reliable than slug withdrawal tests for estimating these hydraulic parameters.

An inherent limitation of slug testing is the small area of investigation of the aquifer due to a small stress applied to the aquifer system. Application of slug testing is restricted to aquifers of low to moderate transmissivity.

SUPERSEDED

4.0 HYDROLOGIC TEST AND PARAMETER EVALUATION

The data collected for each slug test were analyzed to determine the hydrologic parameters (transmissivity and hydraulic conductivity). This section presents a summary of the types of tests conducted for each well, method of analysis, and the calculated values of transmissivity and hydraulic conductivity. Field records, data-logger output, graphs of the data, and as-built diagrams for the completed well are provided in Appendixes A through J. The details of the tests for each well are discussed below.

GENERAL WELL CONSTRUCTION

All tested wells were completed with 10-slot Channel Pack®(a) screens (4-in. inside diameter) surrounded by a 2-in.-thick 16-30 or 20-40 filter pack. The open area of the Channel Pack screens was 28.5 $in.^2/ft$. The screened interval extended from approximately 5 ft above to approximately 15 ft below the top of the aquifer. The porosity of the filter pack is estimated to be 30%. As-built diagrams for each of the wells are presented in the Appendixes.

GENERAL TEST PERFORMANCE

Slug tests were conducted in eight wells in the 200-East Area and two wells in the 200-West Area. All slug tests were performed after the wells were completed, but before they were developed. Multiple slug tests were conducted in most of the wells to increase the likelihood of obtaining a quality data set. It was crucial to coordinate the start of data collection with the initial change in head because the water level was expected to recover exceptionally quickly. The slug withdrawal tests generally provided better quality data to analyze than did the slug injection tests. The water levels were checked for stability between each test.

(a) Channel Pack is a registered trademark of Johnson Filtration Systems, Inc., St. Paul, Minnesota.

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GENERAL DATA ANALYSIS

Values of transmissivity and hydraulic conductivity were determined from most of the slug withdrawal test data and a few of the slug injection test data using the Bouwer and Rice analytical method. The Cooper et al. method can be used in some cases, but provides less reliable results because either 1) the portion of the data "representative" of the aquifer materials is non-unique and can be analyzed using several type curves, or 2) the observed value of H_0, which is important for the analysis, could not be determined accurately. In several tests conducted in highly permeable zones, the observed value of H_0 was not known because the data logger was activated slightly later than initiation of the slugging rod (i.e., t_0 is not known). For other tests where t_0 is known, the observed value of H_0 was not known and could not be determined accurately because of water-level oscillations exhibited at the beginning of the tests.

The observed initial water-level change, Y_0, used in the Bouwer and Rice equation for analyzing the data is less important than H_0 for the Cooper et al. method. The importance in using the Bouwer and Rice method lies in fitting a linear straight line through the data most "representative" of the aquifer formation adjacent to the borehole and taking the y-intercept as Y_0. Small errors in this value have no significant affect in calculating hydraulic conductivity because Y_0 enters Equation (2) as a logarithmic value. However, for the Cooper et al. method, the shape of the data curve, and therefore the result, is heavily dependent on the value of H_0. The Bouwer and Rice method was, therefore, more appropriate for analyzing the test data than the Cooper et al. method.

The theoretical initial water-level change for most of the 200-East Area tests was much larger than the observed value. For these tests, the water level began responding to the imposed stress before the slugging rod was fully withdrawn from or injected into the water column. In applying the Bouwer and Rice method where t_0 is known, or where it was evident that the filter-pack material influenced the early part of the test, the linear best-fit straight line of the data was projected to the intercept to determine Y_0. A correction was, therefore, applied to the elapsed times, t_e, recorded by

the data logger to account for the difference between the initiation of the data logger and the determined time, t_0. In those tests where t_0 was not known, t_0 was assumed to be the time when the observed initial water-level change occurred just before the water level returned exponentially to its pretest level. For these tests, the projected values of Y_0 were approximately the same as the observed values.

The equivalent hydraulic conductivity is an average value for hydraulic conductivity over the entire effective test interval (i.e., "saturated" screen interval). Individual stratigraphic zones within the test interval may possess higher or lower hydraulic conductivities than that calculated for the effective test interval.

WELL 299-E24-19

This well is located on the southwestern edge of the A Tank Farms in the 200-East Area (see Figure 1.1). Refer to Appendix A for the as-built diagram, field records, data-logger output, and graphs of the data.

Stratigraphy

The screened interval is presumed to lie within the undifferentiated sediments of the Hanford/Ringold Formation. The lithology of this interval is a sandy gravel, sand, and muddy sandy gravel. The full saturated thickness of the sediments above the basalt at this location is inferred to be 95 ft, based on available geologic information in Jensen et al. (1989). The bottom of the aquifer is presumed to be the top of the Elephant Mountain Basalt.

Test Performance and Data Analysis

Two slug injection and two slug withdrawal tests were performed on October 2, 1989. The depth of the screened interval was reported to be approximately 280 to 301 ft below land surface. Before conducting the tests, the depth to the "static" water level was determined to be approximately 285 ft below land surface. Therefore, the tests were conducted within the screened interval.

During the slug injection tests (#0 and #8), there was difficulty with the slugging rod "hanging up" in the well, resulting in a water-level change that was not instantaneous. This change caused the water levels to respond before the slugging rod was fully submerged. Data collected from the slug injection tests were not usable for analysis.

For both of the withdrawal tests (tests #1 and #9), withdrawal of the slugging rod yielded an observed initial water-level change of approximately 1.6 ft. The water level fully returned to its pretest level within 17 sec for test #1 and 13 sec for test #9.

The observed initial water-level change for each test was much less than the theoretical value of 4.17 ft, calculated using the dimensions of the 8-ft slugging rod. This difference indicates that formation water was entering the well during withdrawal of the slugging rod. Although this condition violates the assumption requiring an instantaneous water-level change, it does not necessarily invalidate the results. However, the analytical results may be less reliable because of the error in determining the parameters (i.e., Y_o, Y_t, t, H_o) used in the analytical equations.

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The data indicate that initiation of the data logger occurred slightly later than withdrawal of the slugging rod because the equilibrium (reference) water level was "missed." The actual initial water-level change may be slightly higher. However, this difference does not significantly influence the analytical results using the Bouwer and Rice equation. The value of t_o is, therefore, assumed to be elapsed time, $t_e = 0$.

The slug withdrawal data could not be analyzed with the Cooper et al. method because the values for H_o for the tests could not be determined accurately. However, the slug withdrawal data for tests #1 and #9 were analyzed with the Bouwer and Rice method. Semilogarithmic plots of the water-level change versus elapsed time are shown in Appendix A. The data on the graph were approximated with a linear best-fit straight line. The data for $t < 9$ sec (0.15 min) was used to approximate the straight line for test #1, and $t < 3$ sec (0.05 min) was used to approximate the straight line for test #9. The approximated best-fit lines were projected to the Y_t intercept at time $t_o = 0$. These projected values were used for Y_o in the Bouwer and Rice

equation. The projected values of Y_0 were determined to be 1.63 ft for test #1 and 1.58 ft for test #9, close to the observed values of 1.61 and 1.60 ft, respectively.

A summary of the parameters substituted into the Bouwer and Rice equation is presented in Appendix A.

Summary of Test Results

Values of transmissivity and equivalent hydraulic conductivity from the analytical method applied for each of the slug tests are summarized in Table 4.1. The hydraulic properties are determined solely for the entire test interval. The best estimates of these hydraulic properties are determined to be most representative of the test interval.

Analyses of the slug withdrawal data for tests #1 and #9 using the Bouwer and Rice method yielded hydraulic conductivity values of approximately 120 and 100 ft/d, respectively. The best estimate of the equivalent hydraulic conductivity, an average of these values, was determined to be 110 ft/d. The values of hydraulic conductivity multiplied by the thickness of the test interval of 15.6 ft yielded values of transmissivity of approximately

TABLE 4.1. Summary of Hydraulic Property Values Determined for Tests Performed in Well 299-E24-19

Test Method	Analysis Method	Transmissivity,(a) ft^2/d	Equivalent Hydraulic Conductivity, ft/d
Slug Withdrawal (Test #1)	Bouwer and Rice (1976)	1800	120
Slug Withdrawal (Test #9)	Bouwer and Rice (1976)	1600	100
Slug Injection (Tests #0 and #8)	Data Not Analyzable	-	-
Best Estimate		1700	110

(a) Transmissivity was calculated by multiplying equivalent hydraulic conductivity by the thickness of the test interval (i.e., 15.6 ft).

1800 and 1600 ft^2/d, respectively, for the upper part of the aquifer. The best estimate of transmissivity, an average of these values, was determined to be 1700 ft^2/d.

WELL 299-E25-40

This well is located on the east side of the A Tank Farm in the 200-East Area (see Figure 1.1). Refer to Appendix B for the as-built diagram, field records, data-logger output, and graphs of the data.

Stratigraphy

The screened interval is presumed to lie within undifferentiated sediments of the Hanford/Ringold Formation. The lithology of this interval is a sandy gravel and slightly gravelly sand. The full saturated thickness of the sediments above the basalt at this location is inferred to be 95 ft, based on available geologic information in Jensen et al. (1989). The bottom of the aquifer is presumed to be the top of the Elephant Mountain Basalt.

Test Performance and Data Analysis

Two slug injection and two slug withdrawal tests were conducted on September 29, 1989. The depth of the screened interval was reported to be approximately 252 to 273 ft below land surface. Before conducting the tests, the depth to the "static" water level was determined to be approximately 257 ft below land surface. Therefore, the tests were conducted within the screened interval.

Data from the slug injection tests (tests #0 and #2) are not usable for analysis because the slugging rod was not lowered into the water quickly enough. The assumption that requires an instantaneous water-level change at the beginning of the test was grossly violated.

For both of the two withdrawal tests (tests #1 and #3), withdrawal of the slugging rod produced similar results. Test #1 produced an observed initial water-level change of 1.31 ft. The water level for this test fully recovered to its pretest level within 35 sec. Withdrawal of the slugging

rod for test #3 produced an observed initial water-level change of 1.18 ft. The water level for this test fully recovered to its pretest level within 35 sec.

The observed initial water-level change for each test was much less than the theoretical water-level displacement of 4.17 ft expected, calculated using the dimensions of the 8-ft slugging rod. This difference indicates that formation water was entering the well during withdrawal of the slugging rod. Although this condition violates the assumption requiring an instantaneous water-level change, it does not necessarily invalidate the results. However, the analytical results may be less reliable because of the error in determining the parameters (i.e., Y_0, Y_t, t, H_0) used in the analytical equations.

The data indicate that initiation of the data logger occurred slightly later than withdrawal of the slugging rod because the equilibrium (reference) water level was "missed." The actual initial water-level change may be slightly higher. However, this difference does not significantly influence the analytical results using the Bouwer and Rice equation. The value of t_0 is, therefore, assumed to be elapsed time, $t_e = 0$.

The data could not be analyzed with the Cooper et al. method because the values of H_0 for the tests could not be determined. However, the slug withdrawal data for tests #1 and #3 were analyzed with the Bouwer and Rice method. Semilogarithmic plots of the water-level change versus time since the slugging rod was withdrawn are shown in Appendix B. The early portion of the data for $t < 3$ sec (0.05 min) for each of the tests shows a steeper slope than the data for $t > 3$ sec. These steeper slopes during the early portion of the tests are influenced by the filter-pack material adjacent to the well screen. The later-time straight line is considered to be "representative" of the aquifer sediments adjacent to the borehole.

The data on the graphs were approximated with linear best-fit straight lines. For test #1, a straight-line approximation of the data for $2 < t < 10$ sec was projected to the Y_t intercept at time $t_0 = 0$. This projected value, 1.02 ft, was used for Y_0 in the Bouwer and Rice equation. For test #3, a straight-line approximation of the data for $3 < t < 9$ sec was

projected to the Y_t intercept at time $t_o = 0$. This projected value for test #3, 0.83 ft, was used for Y_o in the Bouwer and Rice equation.

A summary of the parameters substituted in the Bouwer and Rice equation is presented in Appendix B.

Summary of Test Results

Values of transmissivity and equivalent hydraulic conductivity from the analytical method applied for each of the slug tests are summarized in Table 4.2. The hydraulic properties are determined solely for the entire test interval. The best estimates of these hydraulic properties are determined to be most representative of the test interval.

Hydraulic conductivity values of approximately 64 and 75 ft/d for slug withdrawal tests #1 and #3, respectively, were calculated using the Bouwer and Rice method. These values of hydraulic conductivity multiplied by the thickness of the test interval of 16.1 ft provide values of transmissivity for the upper part of the aquifer. The best estimate of equivalent hydraulic conductivity, an average of these calculated values, was determined to be 71 ft/d. Transmissivity values were calculated to be approximately 1000 and

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TABLE 4.2. Summary of Hydraulic Property Values Determined for Tests Performed in Well 299-E25-40

Test Method	Analysis Method	Transmissivity,[a] ft^2/d	Equivalent Hydraulic Conductivity, ft/d
Slug Withdrawal (Test #1)	Bouwer and Rice (1976)	1000	64
Slug Withdrawal (Test #3)	Bouwer and Rice (1976)	1200	75
Slug Injection (Tests #0 and #2)	Data Not Analyzable	-	-
Best Estimate		1100	70

(a) Transmissivity was calculated by multiplying equivalent hydraulic conductivity by the thickness of the test interval (i.e., 16.1 ft).

1200 ft^2/d for tests #1 and #3, respectively. The best estimate of transmissivity, an average of these calculated values, was determined to be 1100 ft^2/d.

WELL 299-E25-41

This well is located on the east side of the A Tank Farm in the 200-East Area (see Figure 1.1). Refer to Appendix C for the as-built diagram, field records, data-logger output, and graphs of the data.

Stratigraphy

The screened interval is presumed to lie within the undifferentiated sediments of the Hanford/Ringold Formation. The lithology of this interval is a sandy gravel, muddy sandy gravel, and sandy mud. The full saturated thickness of the sediments above the basalt at this location is inferred to be 95 ft, based on available geologic information in Jensen et al. (1989). The bottom of the aquifer is presumed to be the top of the Elephant Mountain Basalt.

Test Performance and Data Analysis

Two slug injection and two slug withdrawal tests were conducted on September 29, 1989. The depth of the screened interval was reported to be approximately 255 to 276 ft below land surface. Before conducting the tests, the depth to the "static" water level was determined to be approximately 262 ft below land surface. Therefore, the tests were conducted within the screened interval.

Slug Injection Tests (#4 and #6)

Injection of the slugging rod yielded an observed initial water-level change of 0.94 ft for test #4. The observed initial water-level change for test #6 was 0.81 ft, but then rose to 1.42 ft after 4 sec (0.0666 min) before falling exponentially. This rise in water level between 0 and 4 sec indicates that initiation of the data logger occurred before the slugging rod was fully submersed. The water level returned to its pretest level within 0.3 min for test #4 and 5.5 min for test #6.

The observed initial water-level change for each test was less than the theoretical water-level displacement of 4.17 ft expected, calculated using the dimensions of the 8-ft slugging rod. This difference indicates that water in the borehole flowed through the screen into the formation during injection of the slugging rod. Although this condition violates the assumption requiring an instantaneous water-level change, it does not necessarily invalidate the results. However, the analytical results may be less reliable because of the error in determining the parameters (i.e., Y_0, Y_t, t, H_0) used in the analytical equations.

The data indicate that initiation of the data logger occurred slightly later than injection of the slugging rod for test #4 because the equilibrium (reference) water level was "missed." The actual initial water-level change may be slightly higher. However, this difference does not significantly influence the analytical results using the Bouwer and Rice equation. The value of t_0 is, therefore, assumed to be elapsed time, $t_e = 0$.

A correction was applied to the elapsed times for injection test #6 because of the water-level rise caused by the injection of the slugging rod at the beginning of the test. An elapsed time of 0.0666 min (4 sec) was subtracted from all the elapsed times so that $t_0 = 0$ at $t_e = 4$ sec. The data indicate that initiation of the data logger occurred slightly later than the start of injection of the slugging rod because the equilibrium (reference) water level was "missed" at the beginning of the test. Because t_0 is not exactly known, t_0 is assumed to be the elapsed time, $t_e = 4$ sec, when the maximum observed water-level change occurred just before the water level recovered exponentially.

The slug injection data for tests #4 and #6 were analyzed with the Bouwer and Rice method. Semilogarithmic plots of the water-level change versus time (corrected time for test #6) since the slugging rod was injected are shown in Appendix C. The data on the graphs were approximated with linear best-fit straight lines. The early portion of the data for $t < 0.0333$ min (2 sec) was used to approximate a best-fit line for test #4, and data for 0.1 min $< t <$ 0.2166 min was used to approximate a best-fit line

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for test #6. The latter part of the data indicate a curvi-linear relationship in which a number of "apparent" straight lines could be fit. Therefore, these portions of the graphs were not used to approximate the straight lines. The linear best-fit straight lines were projected to the Y_t intercepts at $t = 0$. These intercepts were used for Y_0 in the Bouwer and Rice equation and were determined to be 0.89 ft for test #4 and 1.02 ft for test #6.

A summary of the parameters substituted in the Bouwer and Rice equation is presented in Appendix C.

Slug Withdrawal Tests (#5 and #7)

Data from the withdrawal tests produced similar results. However, removal of the slugging rod during the first withdrawal test (test #5) pinched the transducer cable, causing the transducer to move upward. This upward movement caused the recording of the water-level change to appear greater than the actual water-level change. An arithmetic plot of the data indicates that the transducer moved approximately 1.9 ft. Between 5.5 and 6 min after the slug was withdrawn, the transducer returned to its original position.

For analysis of the data from test #5, all the values corresponding to elapsed times less than 6 min were corrected 1.9 ft to account for movement of the transducer. Application of this correction yielded an observed initial water-level change of approximately 2.55 ft. The water level for this test fully returned to its pretest level within 6.5 min.

Withdrawal of the slugging rod for the second withdrawal test (#7) yielded an observed initial water-level change of 3.27 ft. The water level fully returned to its pretest level within 3.5 min.

The observed initial water-level change for each test was less than the theoretical water-level displacement of 4.17 ft expected, calculated using the dimensions of the 8-ft slugging rod. This difference indicates that formation water was entering the well during withdrawal of the slugging rod. Although this condition violates the assumption requiring an instantaneous water-level change, it does not necessarily invalidate the results.

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However, the analytical results may be less reliable because of the error in determining the parameters (i.e., Y_o, Y_t, t, H_o) used in the analytical equations.

The data indicate that initiation of the data logger occurred slightly later than withdrawal of the slugging rod because the equilibrium (reference) water level was "missed." The actual initial water-level change may be slightly higher. However, this difference does not significantly influence the analytical results using the Bouwer and Rice equation. The value of t_o is, therefore, assumed to be elapsed time, $t_e = 0$.

The data could not be analyzed with the Cooper et al. method because the values of H_o for the tests could not be determined accurately. However, the slug withdrawal data for tests #5 and #7 were analyzed with the Bouwer and Rice method. Semilogarithmic plots of the water-level change versus time since the slugging rod was withdrawn are shown in Appendix C. The data on the graphs were approximated with linear best-fit straight lines. For withdrawal test #5, the early portion of the data for $0.08 < t < 0.15$ min was used to approximate a best-fit line. For withdrawal test #7, the early portion of the data for $t < 0.3$ min was used to approximate a best-fit line. The latter part of the data (i.e., $t > 0.3$ min for test #7 and $t > 0.15$ min for test #5) indicate a curvi-linear relationship in which a number of "apparent" straight lines could be fit. Therefore, these portions of the graphs were not used to approximate the straight lines. The linear best-fit straight lines were projected to the Y_t intercepts at $t_o = 0$. These intercepts were used for Y_o in the Bouwer and Rice equation and were determined to be 1.86 ft for test #5 and 3.18 ft for test #7.

A summary of the parameters substituted in the Bouwer and Rice equation is presented in Appendix C.

Summary of Test Results

Values of transmissivity and equivalent hydraulic conductivity from the analytical method applied for each of the slug tests are summarized in Table 4.3. The hydraulic properties are determined solely for the entire test interval. The best estimates of these hydraulic properties are determined to be most representative of the test interval.

TABLE 4.3. Summary of Hydraulic Property Values Determined for Tests Performed in Well 299-E25-41

Test Method	Analysis Method	Transmissivity,(a) ft^2/d	Equivalent Hydraulic Conductivity, ft/d
Slug Withdrawal (Test #5)	Bouwer and Rice (1976)	290	21
Slug Withdrawal (Test #7)	Bouwer and Rice (1976)	330	24
Slug Injection (Test #4)	Bouwer and Rice (1976)	2500(b)	180
Slug Injection (Test #6)	Bouwer and Rice (1976)	1100(b)	82
Best Estimate		330	24

(a) Transmissivity was calculated by multiplying equivalent hydraulic conductivity by the thickness of the test interval (i.e., 16.1 ft).
(b) Analytical results from the slug injection tests are considered to be overestimates of the test interval.

Analysis of the slug injection data using the Bouwer and Rice method yielded values of hydraulic conductivity of 180 and 82 ft/d for tests #4 and #6, respectively. These values of hydraulic conductivity multiplied by the thickness of the interval tested of 13.8 ft yielded values of transmissivity of approximately 2500 and 1100 ft^2/d, respectively, for the upper part of the aquifer.

Analysis of the slug withdrawal data using the Bouwer and Rice method yielded hydraulic conductivity values of approximately 21 and 24 ft/d for test #5 and #7, respectively. These values of hydraulic conductivity multiplied by the thickness of the test interval of 13.8 ft yielded values of transmissivity of approximately 290 and 330 ft^2/d, respectively, for the upper part of the aquifer.

The best estimates for transmissivity and equivalent hydraulic conductivity were determined to be those from slug withdrawal test #7 because the

value of Y_0 for this test was closest to the theoretical displacement calculated using the dimensions of the 8-ft slugging rod. Also, the analytical results from the slug injection tests are considered to be overestimates of the test interval because the fall of the water level occurred through the vadose zone above the water table. The rate of fall of the water level in the well caused by inflow into the vadose zone is greater than the fall of the water level in the well caused by inflow into the saturated zone. The best estimate for transmissivity was determined to be 330 ft^2/d, and the best estimate for equivalent hydraulic conductivity was determined to be 24 ft/d.

WELL 299-E27-12

This well is located on the western corner of the C Tank Farm in the 200-East Area (see Figure 1.3). Refer to Appendix D for the as-built diagram, field records, data-logger output, and graphs of the data.

Stratigraphy

The screened interval is presumed to lie within the undifferentiated sediments of the Hanford/Ringold Formation. The lithology of this interval is a sandy gravel and a muddy sandy gravel. The full saturated thickness of the sediments above the basalt at this location is inferred to be roughly 50 ft, based on available geologic information in Jensen et al. (1989). The bottom of the aquifer is presumed to be the top of the Elephant Mountain Basalt.

Test Performance and Data Analysis

Two slug injection tests and two slug withdrawal tests were conducted on October 19, 1989. An additional slug withdrawal test was conducted on October 20, 1989. The depth of the screened interval was reported to be approximately 251 to 271 ft below land surface. Before conducting the tests, the depth to the "static" water level was determined to be approximately 253 ft below land surface. Therefore, the tests were conducted within the screened interval.

Arithmetic plots of the data for the slug injection tests (tests #4 and #6) are shown in Appendix D. The water level appears to have oscillated

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about the equilibrium water level before attenuating to its pretest level. An exponential fall in the water level was not observed. The oscillations attenuated within 3 sec for test #4 and within 4 sec for test #6.

Data from the slug injection tests are not usable for analysis because the slugging rod was not lowered into the water quickly enough to allow for an exponential fall in the water level during the early part of the test. The assumption that requires an instantaneous water-level change was grossly violated.

The water-level responsed extremely quickly in other slug tests conducted at this well and in tests conducted at other wells in the 200-East Area. The exponential fall in the water level during the slug injection tests, as "seen" by the aquifer, possibly dissipated before the water-level fluctuations, an artifact of injecting the slugging rod, attenuated.

Arithmetic plots of the data for the slug withdrawal tests (tests #0, #5, and #7) are shown in Appendix D. The response of the water level in each of these tests was similar. The data indicate that the observed initial water-level change is much less than the theoretical value of 1.90 ft, calculated using the dimensions of the 6-ft slugging rod. The assumption that requires an instantaneous water-level change is, therefore, grossly violated. The data for these tests cannot be analyzed.

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WELL 299-E27-13

This well is located on the southwestern side of the C Tank Farm in the 200-East Area (see Figure 1.3). Refer to Appendix E for the as-built diagram, field records, data-logger output, and graphs of the data.

Stratigraphy

The screened interval is presumed to lie within the undifferentiated sediments of the Hanford/Ringold Formation. The lithology of this interval is a gravel and a sandy gravel. The full saturated thickness of the sediments above the basalt at this location is inferred to be roughly 50 ft, based on available geologic information in Jensen et al. (1989). The bottom of the aquifer is presumed to be the top of the Elephant Mountain Basalt.

Test Performance and Data Analysis

Two slug withdrawal tests were performed with the 6-ft slugging rod on October 20, 1989. The depth of the screened interval was reported to be approximately 254 to 275 ft below land surface. Before conducting the tests, the depth to the "static" water level was determined to be approximately 261 ft below land surface. Therefore, the tests were conducted within the screened interval.

Withdrawal of the slugging rod yielded observed initial water-level changes of 0.53 ft for test #1 and 1.07 ft for test #2, both occurring at an elapsed time of 0.4 sec (0.0066 min) after initiation of the data logger. The water level returned to the pretest level within 5 and 11 sec, respectively.

The data indicate that the initial water-level change is much less than the theoretical water-level displacement of 1.90 ft expected, calculated using the dimensions of the 6-ft slugging rod. This difference indicates that formation water was entering the well during withdrawal of the slugging rod. Although this condition violates the assumption requiring an instantaneous water-level change, it does not necessarily invalidate the results. However, the analytical results may be less reliable because of the error in determining the parameters (i.e., Y_o, Y_t, t, H_o) used in the analytical equations.

The slug withdrawal data could not be analyzed with the Cooper et al. method because the values of H_o for the tests could not be determined accurately. However, the slug withdrawal data for tests #1 and #2 were analyzed with the Bouwer and Rice method. Semilogarithmic plots of the water-level change versus time since the slugging rod was withdrawn are shown in Appendix E. For the analysis, a correction was applied to the elapsed times to eliminate effects of the slugging rod as it was being withdrawn. Four tenths of a second was subtracted from all the elapsed times for each of the tests so that $t_o = 0$ at $t_e = 0.4$ sec. Initiation of the data logger must have occurred a fraction of a second later than the start of withdrawal of the slugging rod because the data indicate that the equilibrium (reference) water

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level was "missed" at the beginning of the test. Because t_o is not exactly known, t_o is assumed to be the time, t_e = 0.4 sec, when the maximum observed water-level change occurred.

The data on the graphs were approximated with linear best-fit straight lines. For test #1, a straight-line approximation of the data for time less than approximately 1 sec was projected to the Y_t intercept at time t_o = 0. For test #2, a straight-line approximation of the data for t < 6.6 sec was projected to the Y_t intercept at time t_o = 0. These projected values, 0.56 ft for test #1 and 1.07 ft for test #2, were used for Y_o in the Bouwer and Rice equation.

A summary of the parameters substituted into the Bouwer and Rice equation is presented in Appendix E.

Summary of Test Results

Values of transmissivity and equivalent hydraulic conductivity from the analytical methods applied for each of the slug tests are summarized in Table 4.4. The hydraulic properties were determined solely for the entire test interval. The best estimates of these hydraulic properties are determined to be most representative of the test interval.

Analysis of the slug withdrawal data using the Bouwer and Rice method yielded values of hydraulic conductivity of 410 ft/d for test #1 and 180 ft/d for test #2. These values of hydraulic conductivity multiplied by the thickness of the test interval of 13.9 ft yielded values of transmissivity of 5700 and 2500 ft^2/d, respectively, for the upper part of the aquifer.

The values from test #2 are considered to be the best estimates of transmissivity and equivalent hydraulic conductivity of the test interval because the value of Y_o used in the calculations is closer to the theoretical value, calculated using the dimensions of the slugging rod.

WELL 299-E27-14

This well is located on the southeastern side of C the Tank Farm in the 200-East Area (see Figure 1.3). Refer to Appendix F for the as-built diagram, field records, data-logger output, and graphs of the data.

TABLE 4.4. Summary of Hydraulic Property Values Determined for Tests Performed in Well 299-E27-13

Test Method	Analysis Method	Transmissivity,(a) ft^2/d	Equivalent Hydraulic Conductivity, ft/d
Slug Withdrawal (Test #1)	Bouwer and Rice (1976)	5700	410
Slug Withdrawal (Test #2)	Bouwer and Rice (1976)	2500	180
Best Estimate		2500	180

(a) Transmissivity was calculated by multiplying equivalent hydraulic conductivity by the thickness of the test interval (i.e., 13.9 ft).

Stratigraphy

The screened interval is presumed to lie within the undifferentiated sediments of the Hanford/Ringold Formation. The lithology of this interval is a sand, gravelly sand, and sandy gravel. The full saturated thickness of the sediments above the basalt at this location is inferred to be roughly 50 ft, based on available geologic information in Jensen et al. (1989). The bottom of the aquifer is presumed to be the top of the Elephant Mountain Basalt.

Test Performance and Data Analysis

Three slug withdrawal tests (tests #3, #4, and #5) were performed on October 20, 1989. The depth of the screened interval was reported to be approximately 246 to 267 ft below land surface. Before conducting the tests, the depth to the "static" water level was determined to be approximately 250 ft below land surface. Therefore, the tests were conducted within the screened interval.

The water level oscillated at the beginning of each of the tests before it recovered exponentially with time. For test #3, the data show that the data logger recorded a value of -4.69 ft at an elapsed time of 0.4 sec (0.0066 min) after initiation of the data logger. This change in water level

is much greater than the theoretical water-level displacement of 1.9 ft expected with the 6-ft slugging rod in a 4-in.-dia well. This difference indicates that the fluctuations in water level at the beginning of the tests may be the result of erroneous water-level measurements caused by a fluid column of air and water created at the instant the slugging rod was withdrawn. These fluctuations may also be influenced by induced inertial effects.

The data indicate that the observed initial water-level change for test #3 (just before the water level began to rise exponentially) was 1.54 ft. The water level returned to its pretest level within 11 sec. The observed initial water-level change for test #5 (just before the water level began to rise exponentially) was 1.08 ft. The water level returned to its pretest level within 10 sec.

For test #4, the observed initial water-level change was over 4 ft before rising exponentially. The water level rose to and leveled off at 2.66 ft below the equilibrium water level 17 sec into the test and then gradually rose to its pretest level within 7 min. This observed initial water-level change of over 4 ft is much greater than the theoretical water-level displacement of 1.9 ft expected with the 6-ft slugging rod. The water-level response recorded by the data logger after 17 sec does not resemble the responses recorded for tests #3 and #5. The data for test #4 are suspect and may be the result of upward movement of the transducer during withdrawal of the slugging rod. This upward movement would cause the water-level changes to appear greater than the actual water-level changes. To correct for this movement, 2.66 ft was added to the recorded values. Only those data for $t < 17$ sec were analyzed.

The slug withdrawal data could not be analyzed with the Cooper et al. method because the values of H_0 for the tests could not be determined accurately. However, the slug withdrawal data for tests #3, #4, and #5 were analyzed using the Bouwer and Rice method. Semilogarithmic plots of the water-level change versus time since the slugging rod was withdrawn are shown in Appendix F. For test #3 and #4, a correction was applied to the elapsed times because of the time difference between initiation of the data logger

and withdrawal of the slugging rod. The data indicate that the slugging rod was withdrawn between 0.2 sec (0.0033 min) and 0.4 sec (0.0066 min) elapsed time, t_e, for test #3 and between 0.6 sec (0.0099 min) and 0.8 sec (0.0133 min) elapsed time for test #4. The time the slugging rod was withdrawn, t_o, is chosen as a midpoint between these elapsed times (i.e., $t_o = 0$ at $t_e = 0.3$ sec for test #3 and $t_o = 0$ at $t_e = 0.7$ sec for test #4). Therefore, 0.3 and 0.7 sec were subtracted from all the elapsed times for tests #3 and #4, respectively.

For test #5, the data indicate that the slugging rod was withdrawn before the data logger was initiated because the equilibrium water level was "missed." The elapsed times for test #5 were shifted 1.2 sec in the positive direction so that the exponential portion of the data for test #5 matches the exponential portion of the data for test #3. The correction of 0.3 sec applied to test #3 to account for the time difference between initiation of the data logger and the withdrawal of the slugging rod was also applied to the data for test #5, yielding a net positive shift of 0.9 sec for test #5. These corrections allow some consistency between the analyses for each test.

The times, t_o, for tests #3 and #4 are known because the data logger was initiated before the slugging rod was withdrawn (i.e, the data logger recorded the equilibrium water level). Therefore, a linear best-fit straight line through the data can be projected to the Y_t intercept at $t_o = 0$. The value at the intercept, Y_o, was determined to be 2.86 ft for test #3 and 3.42 ft for test #4. For test #5, Y_o was determined to be 3.28 ft. These values were used for the calculations in the Bouwer and Rice equation. The data for which the straight lines were fit were 2.7 sec $< t <$ 6.7 sec for test #3, 3.3 sec $< t <$ 8.3 sec for test #4, and $t <$ 9 sec for test #5.

A summary of the parameters substituted into the Bouwer and Rice equation for each test is presented in Appendix F.

Summary of Test Results

A summary of slug test results for each of the tests is presented in Table 4.5. The hydraulic properties are determined solely for the entire test interval. The best estimates of these hydraulic properties are determined to be most representative of the test interval.

TABLE 4.5. Summary of Hydraulic Property Values Determined for Tests Performed in Well 299-E27-14

Test Method	Analysis Method	Transmissivity,(a) ft^2/d	Equivalent Hydraulic Conductivity, ft/d
Slug Withdrawal (Test #3)	Bouwer and Rice (1976)	2600	160
Slug Withdrawal (Test #4)	Bouwer and Rice (1976)	2400	150
Slug Withdrawal (Test #5)	Bouwer and Rice (1976)	2900	180
Best Estimate		2600	160

(a) Transmissivity was calculated by multiplying equivalent hydraulic conductivity by the thickness of the test interval (i.e., 16.0 ft).

Analyses of the slug withdrawal data using the Bouwer and Rice method yielded values of hydraulic conductivity of 160, 150, and 180 ft/d for tests #3, #4, and #5, respectively. These values of hydraulic conductivity multiplied by the thickness of the test interval of 16.0 ft yielded values of transmissivity of 2600, 2400, and 2900 ft^2/d, respectively, for the upper part of the aquifer.

The best estimates of transmissivity and equivalent hydraulic conductivity of the test interval are those values determined from test #3 because of possible errors associated with shifting the data for tests #4 and #5. The best estimate for transmissivity is 2600 ft^2/d, and the best estimate for equivalent hydraulic conductivity is 160 ft/d.

WELL 299-E27-15

This well is located on the northwestern side of the C Tank Farm in the 200-East Area (see Figure 1.3). Refer to Appendix G for the field records, raw data, graphs of the data, and as-built diagrams.

Stratigraphy

The screened interval is presumed to lie within the undifferentiated sediments of the Hanford/Ringold Formation. The lithology of this interval is a muddy sandy gravel. The full saturated thickness of the sediments above the basalt at this location is inferred to be roughly 50 ft, based on available geologic information in Jensen et al. (1989). The bottom of the aquifer is presumed to be the top of the Elephant Mountain Basalt.

Test Performance and Data Analysis

Two slug injection tests and two slug withdrawal tests were conducted on October 19, 1989. The depth of the screened interval was reported to be approximately 241 to 261 ft below land surface. Before conducting the tests, the depth to the "static" water level was determined to be approximately 245 ft below land surface. Therefore, the tests were conducted within the screened interval.

Data from the slug injection tests (tests #0 and #2) are not usable for analysis because the slugging rod was not lowered into the water quickly enough. The assumption requiring an instantaneous initial water-level change was grossly violated.

Withdrawal of the slugging rod during test #1 yielded an observed initial water-level change of approximately 1 ft at an elapsed time of 0.6 sec after the data logger was initiated. After that time, the water level returned to its pretest level within 6.4 sec.

The data for test #1 indicate that the initial water-level change is much less than the theoretical water-level displacement of 1.90 ft expected, calculated using the dimensions of the 6-ft slugging rod. This difference indicates that formation water was entering the well during withdrawal of the slugging rod. Although this condition violates the assumption requiring an instantaneous water-level change, it does not necessarily invalidate the results. However, the analytical results may be less reliable because of the error in determining the parameters (i.e., Y_0, Y_t, t, H_0) used in the analytical equations.

The slug withdrawal data could not be analyzed with the Cooper et al. method because the value of H_0 for the test could not be accurately determined. However, the data for test #1 were analyzed with the Bouwer and Rice method. A semilogarithmic plot of water-level change versus time since the slugging rod was withdrawn is shown in Appendix G. A correction was applied to the elapsed times to eliminate the effects from withdrawal of the slugging rod at the beginning of the test. An elapsed time of 0.0099 min (0.6 sec) was subtracted from all the elapsed times so that $t_o = 0$ at $t_e = 0.6$ sec. Initiation of the data logger occurred slightly later than the start of withdrawal of the slugging rod because the data indicate that the equilibrium (reference) water level was "missed" at the beginning of the test. Because t_o is not exactly known, t_o is assumed to be the elapsed time, $t_e = 0.6$ sec, when the maximum observed water-level change occurred.

The data on the graph were approximated with a linear best-fit straight line. A straight-line approximation of the data for time less than 0.0234 min (1.4 sec) was projected to the Y_t intercept at time $t_o = 0$. This projected value, 0.96 ft, was used for Y_o in the Bouwer and Rice equation.

A summary of the parameters substituted into the Bouwer and Rice equation is presented in Appendix G.

Summary of Test Results

A summary of the slug test results is presented in Table 4.6. The hydraulic properties are determined solely for the entire test interval. The best estimates of these hydraulic properties are determined to be most representative of the test interval.

Analysis of the slug withdrawal data using the Bouwer and Rice method yielded a hydraulic conductivity value of approximately 390 ft/d for test #1. This value of hydraulic conductivity multiplied by the thickness of the test interval of 14.3 ft yielded a transmissivity of approximately 5600 ft^2/d for the upper part of the aquifer.

Withdrawal of the slugging rod during test #3 occurred late with respect to initiation of the data logger, yielding data during the data collection sequence of a 1-sec time interval. This rate of data collection is

TABLE 4.6. Summary of Hydraulic Property Values Determined for Tests Performed in Well 299-E27-15

Test Method	Analysis Method	Transmissivity,(a) ft^2/d	Equivalent Hydraulic Conductivity, ft/d
Slug Withdrawal (Test #1)	Bouwer and Rice (1976)	5600	390
Slug Withdrawal (Test #3)	Insufficient Data	-	-
Slug Injection (Tests #0 and #2)	Data Not Analyzable	-	-
Best Estimate		5600	390

(a) Transmissivity was calculated by multiplying equivalent hydraulic conductivity by the thickness of the test interval (i.e., 14.3 ft).

insufficient for analysis because of a lack of data collected during the early portion of the test after the slugging rod was withdrawn.

WELL 299-E33-33

This well is located east of the B Tank Farms in the 200-East Area (see Figure 1.2). Refer to Appendix H for the as-built diagram, field records, data-logger output, and graphs of the data.

Stratigraphy

The screened interval is presumed to lie within the Hanford formation. The lithology of this interval is a muddy sandy gravel. The full saturated thickness of the sediments above the basalt at this location is 20 ft. The bottom of the aquifer, which is the top of the underlying Elephant Mountain basalt, was encountered at this well.

Test Performance and Data Analysis

Two slug injection tests and one slug withdrawal test were conducted on September 27, 1989. The depth of the screened interval was reported to be approximately 227 to 248 ft below land surface. Before conducting the tests,

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the depth to the "static" water level was determined to be approximately 232 ft below land surface. Therefore, the tests were conducted within the screened interval.

Data from the slug injection tests (tests #0 and #1) are not usable for analysis because the slugging rod was not lowered into the water quickly enough. The assumption requiring an instantaneous initial water-level change was grossly violated.

The withdrawal test (test #2) yielded an observed initial water-level change of approximately 1.2 ft at an elapsed time of 0.8 sec after the data logger was initiated. The water level returned approximately to its pretest level in less than 5 sec. The water level did not return exactly to its pretest level possibly because the transducer moved during the test.

The observed initial water-level change is much less than the theoretical water-level displacement of 4.17 ft expected, calculated using the dimensions of the 8-ft slugging rod. In addition, the slugging rod was still being withdrawn after the data logger was initiated, as indicated by the decline in water level between 0 and 0.8 sec elapsed time. This difference indicates that formation water was entering the well during withdrawal of the slugging rod. Although this condition violates the assumption requiring an instantaneous water-level change, it does not necessarily invalidate the results. However, the analytical results may be less reliable because of the error in determining the parameters (i.e., Y_o, Y_t, t, H_o) used in the analytical equations.

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The slug withdrawal data could not be analyzed with the Cooper et al. method because the value of H_o for the test could not be determined accurately. However, the slug withdrawal data for test #2 were analyzed with the Bouwer and Rice method. A semilogarithmic plot of the water-level change versus time since the slugging rod was removed is shown in Appendix H. A correction was applied to the elapsed times to eliminate the effects from withdrawal of the slugging rod at the beginning of the test. An elapsed time of 0.0133 min (0.8 sec) was subtracted from all the elapsed times so that $t_o = 0$ at $t_e = 0.8$ sec. Initiation of the data logger must have occurred slightly later than the start of withdrawal of the slugging rod because the

data indicate that the equilibrium (reference) water level was "missed" at the beginning of the test. Because t_0 is not exactly known, t_0 is assumed to be the elapsed time, t_e = 0.8 sec, when the maximum observed water-level change occurred.

The data on the graph were approximated with a linear best-fit straight line. A straight-line approximation of the data for time less than approximately 0.02 min (1.2 sec) was projected to the Y_t intercept at time t_0 = 0. This projected value, 1.20 ft, was used for Y_0 in the Bouwer and Rice equation. The observed value for Y_0 was 1.19 ft.

Summary of Test Results

A summary of slug test results is presented in Table 4.7. The hydraulic properties are determined solely for the entire test interval. The best estimates of these hydraulic properties are determined to be most representative of the test interval.

Analysis of the slug withdrawal data for test #2 using the Bouwer and Rice method yielded a hydraulic conductivity value of approximately 320 ft/d.

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TABLE 4.7. Summary of Hydraulic Property Values Determined for Tests Performed in Well 299-E33-33

Test Method	Analysis Method	Transmissivity,(a) ft^2/d	Equivalent Hydraulic Conductivity, ft/d
Slug Withdrawal (Test #2)	Bouwer and Rice (1976)	5400	320
Slug Injection (Tests #0 and #1)	Data Not Analyzable	-	-
Best Estimate		5400	320

(a) Transmissivity was calculated by multiplying equivalent hydraulic conductivity by the thickness of the test interval (i.e., 17.0 ft).

The value of hydraulic conductivity multiplied by the thickness of the test interval of 17.0 ft yielded a transmissivity of approximately 5400 ft^2/d for the upper part of the aquifer.

These values are considered to be the best (and only) estimates of transmissivity and equivalent hydraulic conductivity of the test interval.

WELL 299-W10-15

This well is located on the north side of the T Tank Farm in the 200-West Area (see Figure 1.4). Refer to Appendix I for the as-built diagram, field records, data-logger output, and graphs of the data.

Stratigraphy

The screened interval is presumed to lie within the middle unit of the Ringold Formation. The lithology of this interval is a sandy gravel. The full saturated thickness of the sediments above the basalt at this location is inferred to be 275 ft, based on available geologic information in Jensen et al. (1989). The bottom of the aquifer is presumed to be either the top of one of the fine-grained units of the Ringold Formation or the top of the underlying Elephant Mountain Basalt.

Test Performance and Data Analysis

Two slug withdrawal tests were performed on November 3, 1989, both producing similar results. The depth of the screened interval was reported to be approximately 201 to 222 ft below land surface. Before conducting the tests, the depth to the "static" water level was determined to be approximately 206 ft below land surface. Therefore, the tests were conducted within the screened interval.

The water level oscillated at the beginning of each of the tests before it recovered exponentially with time. The data show that the data logger recorded values of -7.52 ft at an elapsed time of 0.4 sec (0.0033 min) after initiation of the data logger for test #2 and -15.19 ft at an elapsed time of 0.6 sec (0.0099 min) after initiation of the data logger for test #3. These changes in water level are much greater than the theoretical water-level displacement of 1.9 ft expected with the 6-ft slugging rod in a 4-in.-dia well.

These recorded values indicate that the fluctuations in water level may be the result of erroneous water-level measurements caused by a fluid column of air and water created at the instant the slugging rod was withdrawn. These fluctuations may also be influenced by induced inertial effects.

An arithmetic plot of the data indicates that the observed initial water-level change was 1.97 ft for test #2 and 1.93 ft for test #3. These initial values are close to the theoretical water-level displacement of 1.90 ft expected, calculated using the dimensions of the slugging rod. The water level fully returned to its pretest level within 58 sec for test #2 and 53 sec for test #3.

A correction was applied to the elapsed times because of the time difference between initiation of the data logger and withdrawal of the slugging rod. For test #2, the data indicate that the slugging rod was withdrawn between 0.2 sec (0.0033 min) and 0.4 sec (0.0066 min) elapsed time, t_e. The time the slugging rod was withdrawn, t_0, is chosen as a midpoint between these elapsed times (i.e., $t_0 = 0$ at $t_e = 0.3$ sec). For test #3, the slugging rod was withdrawn between 0.4 sec (0.0066 min) and 0.6 sec (0.0099 min) elapsed time. The t_0 value for test #3 is 0.5 sec. Therefore, 0.3 and 0.5 sec were subtracted from all the elapsed times for tests #2 and #3, respectively, for analysis.

Hydraulic property values could not be determined from the Cooper et al. analytical method. The portion of the data considered to be "representative" of the aquifer materials is non-unique and can be analyzed using several type curves. However, the data for tests #2 and #3 were analyzed with the Bouwer and Rice method. Semilogarithmic plots of the water-level change versus time (i.e., corrected time) since the slugging rod was removed are shown in Appendix I. The data on the graphs were approximated with linear best-fit straight lines. The latter part of the data (i.e., $t > 30$ sec for tests #2 and #3) indicate a curvi-linear relationship and therefore were not used to approximate the straight lines. The approximated best-fit lines were projected to the Y_t intercept at time $t_0 = 0$. These projected values at the intercept, 2.15 ft for test #2 and 2.13 ft for test #3, were used for Y_0 in the Bouwer and Rice equation.

A summary of the parameters substituted into the Bouwer and Rice equation is presented in Appendix I.

Summary of Test Results

Values of transmissivity and equivalent hydraulic conductivity from the analytical methods applied for each of the slug tests are summarized in Table 4.8. The hydraulic properties are determined solely for the entire test interval. The best estimates of these hydraulic properties are determined to be most representative of the test interval.

Hydraulic conductivity values of 32 and 34 ft/d were calculated for tests #2 and #3, respectively, using the Bouwer and Rice equation. These values of hydraulic conductivity multiplied by the thickness of the test interval of 15.8 ft yielded values of transmissivity of approximately 510 and 540 ft^2/d, respectively, for the upper part of the aquifer.

TABLE 4.8. Summary of Hydraulic Property Values Determined for Tests Performed in Well 299-W10-15

Test Method	Analysis Method	Transmissivity,(a) ft^2/d	Equivalent Hydraulic Conductivity, ft/d
Slug Withdrawal (Test #2)	Bouwer and Rice (1976)	510	32
Slug Withdrawal (Test #3)	Bouwer and Rice (1976)	540	34
Slug Withdrawal (Test #2)	Cooper et al. (1967)	Non-unique Solution	
Slug Withdrawal (Test #3)	Cooper et al. (1967)	Non-unique Solution	
Best Estimate		530	33

(a) Transmissivity was calculated by multiplying equivalent hydraulic conductivity by the thickness of the test interval (i.e., 15.8 ft).

The best estimate of transmissivity, an average value, was determined to be 530 ft^2/d. The best estimate of equivalent hydraulic conductivity, an average value, was determined to be 33 ft/d.

WELL 299-W10-16

This well is located on the south side of the T Tank Farm in the 200-West Area (see Figure 1.4). Refer to Appendix J for the as-built diagram, field records, data-logger output, and graphs of the data.

Stratigraphy

The screened interval is presumed to lie within the middle unit of the Ringold Formation. The lithology of this interval is a sandy gravel. The full saturated thickness of the sediments above the basalt at this location is inferred to be 275 ft, based on available geologic information in Jensen et al. (1989). The bottom of the aquifer is presumed to be either the top of one of the fine-grained units of the Ringold Formation or the top of the underlying Elephant Mountain Basalt.

Test Performance and Data Analysis

One slug withdrawal and one slug injection test were performed on October 30, 1989. The depth of the screened interval was reported to be approximately 198 to 219 ft below land surface. Before conducting the tests, the depth to the "static" water level was determined to be approximately 203 ft below land surface. Therefore, the tests were conducted within the screened interval.

The water level oscillated at the beginning of each of the tests before it recovered exponentially with time. The data show that the data logger recorded a value of -8.46 ft at an elapsed time of 0.8 sec (0.0133 min) after initiation of the data logger for the withdrawal test (test #3). This change in water level is greater than the theoretical water-level displacement of 1.9 ft expected with the 6-ft slugging rod in a 4-in.-dia well. This difference indicates that the fluctuations in water level may be the result of erroneous water-level measurements caused by a fluid column of air and water

created at the instant the slugging rod was withdrawn. These fluctuations may also be influenced by induced inertial effects.

An arithmetic plot of the data for withdrawal test #3 indicates that the observed initial water-level change was 1.65 ft. This value is less than the theoretical water-level displacement of 1.90 ft expected, calculated using the dimensions of the 6-ft slugging rod. This difference indicates that formation water was entering the well during withdrawal of the slugging rod. Although this condition violates the assumption requiring an instantaneous water-level change, it does not necessarily invalidate the results. However, the analytical results may be less reliable because of the error in determining the parameters (i.e., Y_o, Y_t, t, H_o) used in the analytical equations. The water level fully recovered to its pretest level within 82 sec.

For the slug withdrawal test, a correction was applied to the recorded elapsed times because of the time difference between initiation of the data logger and withdrawal of the slugging rod. For this test, the data indicate that the slugging rod was withdrawn between 0.6 sec (0.0099 min) and 0.8 sec (0.0133 min) elapsed time. The time the slugging rod was withdrawn, t_o, is chosen as a midpoint between these elapsed times (i.e., $t_o = 0$ at $t_e = 0.7$ sec). Therefore, 0.7 sec was subtracted from all the elapsed time values for test #3 for analysis.

The data for test #3 were analyzed with the Bouwer and Rice methods. A semilogarithmic plot of the water-level change versus time (i.e., corrected time) since the slugging rod was removed is shown in Appendix J. The early portion of the data ($t < 25$ sec) on the graph was approximated with a linear best-fit straight line. For $t > 25$ sec, the data indicate a curvi-linear relationship and therefore were not used to approximate the straight line. The approximated best-fit line was projected to the Y_t intercept at time $t_o = 0$. This projected value at the intercept, 2.05 ft, was used for Y_o in the Bouwer and Rice equation.

The Bouwer and Rice method yielded an equivalent hydraulic conductivity of approximately 33 ft/d for test #3. This value of equivalent hydraulic conductivity multiplied by the thickness of the test interval of 16.4 ft

yielded a value of transmissivity of 540 ft^2/d for the upper part of the aquifer. A summary of the parameters substituted into the Bouwer and Rice equation is presented in Appendix J.

For slug injection test #2, water-level fluctuations occurred at the beginning of the test. The data logger recorded values greater than the theoretical water-level displacement of 1.9 ft expected at the beginning of the test. This difference indicates that these fluctuations may be the result of erroneous water-level measurements caused by a fluid column of air and water created at the instant the slugging rod was injected. These fluctuations may also be influenced by induced inertial effects.

An arithmetic plot of the data indicates that the observed initial water-level change (just before recovering exponentially) was 0.85 ft for injection test #2. This value is less than the theoretical water-level displacement of 1.90 ft expected, calculated using the dimensions of the 6-ft slugging rod. This difference indicates that borehole water flowed through the screen into the formation during injection of the slugging rod. Although this condition violates the assumption requiring an instantaneous water-level change, it does not necessarily invalidate the results. However, the analytical results may be less reliable because of the error in determining the parameters (i.e., Y_o, Y_t, t, H_o) used in the analytical equations.

The water level recovered to its pretest level within approximately 45 sec. However, the water level did not recover exactly to its pretest level, possibly because the transducer moved during injection of the slugging rod.

A correction was applied to the slug injection test data because of the water-level fluctuations that occurred at the beginning of the test. An elapsed time of 0.05 min (3 sec) was subtracted from all the elapsed times so that $t_o = 0$ at $t_e = 3$ sec. Initiation of the data logger must have occurred slightly later than injection of the slugging rod because the data indicate that the equilibrium (reference) water level was "missed" at the beginning of the test. Because t_o is not exactly known, t_o is assumed to be the elapsed time, $t_e = 3$ sec, when the maximum observed water-level change occurred just before the water level recovered exponentially.

The data for test #2 were analyzed with the Bouwer and Rice method. A semilogarithmic plot of the water-level change versus time (i.e., corrected time) since the slugging rod was injected is shown in Appendix J. The early portion of the data ($t < 9$ sec) on the graph was approximated with a linear best-fit straight line. For $t > 9$ sec, the data indicate a curvi-linear relationship and therefore were not used to approximate the straight line. The approximated best-fit line was projected to the Y_t intercept at time $t_o = 0$. This projected value at the intercept, 0.91 ft, was used for Y_o in the Bouwer and Rice equation.

A summary of the parameters substituted into the Bouwer and Rice equation is presented in Appendix J.

Summary of Test Results

Values of transmissivity and equivalent hydraulic conductivity from the analytical methods applied for each of the slug tests are summarized in Table 4.9. The hydraulic properties are determined solely for the entire test interval. The best estimates of these hydraulic properties are determined to be most representative of the test interval.

The Bouwer and Rice method yielded an equivalent hydraulic conductivity of approximately 41 ft/d for test #2. This value of equivalent hydraulic conductivity multiplied by the thickness of the test interval of 16.4 ft yielded a value of transmissivity of 670 ft^2/d for the upper part of the aquifer.

The best estimate of transmissivity was determined to be 540 ft^2/d, the value calculated from the slug withdrawal test (test #3). The results from this test are considered to yield the best estimates of the hydraulic properties because the observed initial water-level change was closer to the theoretical water-level displacement of 1.9 ft expected with the 6-ft slugging rod. Smaller differences between the observed and theoretical water-level displacement reduced the error in the calculations.

In addition, the analytical results from the slug injection test are considered to be overestimates of the test interval because the fall of the water level occurred through the vadose zone above the water table. The

TABLE 4.9. Summary of Hydraulic Property Values Determined for Tests Performed in Well 299-W10-16

Test Method	Analysis Method	Transmissivity,(a) ft^2/d	Equivalent Hydraulic Conductivity, ft/d
Slug Injection (Test #2)	Bouwer and Rice (1976)	670(b)	41
Slug Withdrawal (Test #3)	Bouwer and Rice (1976)	540	33
Slug Injection (Test #2)	Cooper et al. (1967)	Non-unique Solution	
Slug Withdrawal (Test #3)	Cooper et al. (1967)	Non-unique Solution	
Best Estimate		540	33

(a) Transmissivity was calculated by multiplying equivalent hydraulic conductivity by the thickness of the test interval (i.e., 16.4 ft).
(b) Analytical results from the slug injection tests are considered to be overestimates of the test interval.

rate of fall of the water level in the well caused by inflow into the vadose zone is greater than the fall of the water level in the well caused by inflow into the saturated zone.

The best estimate of equivalent hydraulic conductivity was determined to be 33 ft/d.

Hydraulic property values could not be determined from the slug withdrawal test (#3) using the Cooper et al. analytical method. The portion of the data considered to be "representative" of the aquifer materials is non-unique and can be analyzed using several type curves. The slug injection test (#2) data could not be analyzed with the Cooper et al. method because the value of H_0 for the test could not be determined accurately.

5.0 REFERENCES

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Roberson, J. A., and C. T. Crowe. 1985. Engineering Fluid Mechanics. 3rd ed., Houghton Mifflin Company, Boston, Massachusetts.

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9310613.1146

APPENDIX A

TEST DATA AND ANALYSIS FOR WELL 299-E24-19

9330018.0448

APPENDIX A

TEST DATA AND ANALYSIS FOR WELL 299-E24-19

This appendix contains the as-built diagram for the well construction, Slug Test Record Form, Aquifer Test Data Sheets, Equipment Record Forms, Electronic Data Control Forms, and accompanying data logs and plots for well 299-E24-19.

9330018.0145

Battelle
Pacific Northwest Laboratories

AS-BUILT DIAGRAM

Well Number 299-E24-19 Geologist GOODWIN, AIRHART, LUBRECHT, KENNEDY Page 1 of 3

Reviewed by J.V. McGee Date 12-8-89

Construction Data		Depth in Feet	Geologic/Hydrologic Data	
Description	Diagram		Diagram Litho.	Lithologic Description
151'10" OF 10" CARBON STEEL CASING		5'		MUDDY SAND
		10'		GRAVELLY MUDDY SAND
		15'		GRAVELLY SAND
302'6" OF 8" CARBON STEEL CASING		20'		SAND
		25'		SLIGHTLY GRAVELLY SAND
		30'		SANDY GRAVEL
290.57' OF 4" STAINLESS STEEL CASING		35'		" "
		40'		" "
		45'		GRAVELLY SAND
		50'		SANDY GRAVEL
		55'		" "
		60'		MUDDY SAND @ 56' SAND
		65'		"
		70'		GRAVELLY SAND
		75'		" "
		80'		" "
		85'		" "
		90'		" "
		95'		SANDY GRAVEL
		100'		" "
		105'		" "
		110'		GRAVELLY SAND
		115'		" "
		120'		" "
		125'		SAND
		130'		"

A-1800-186 (3/87)

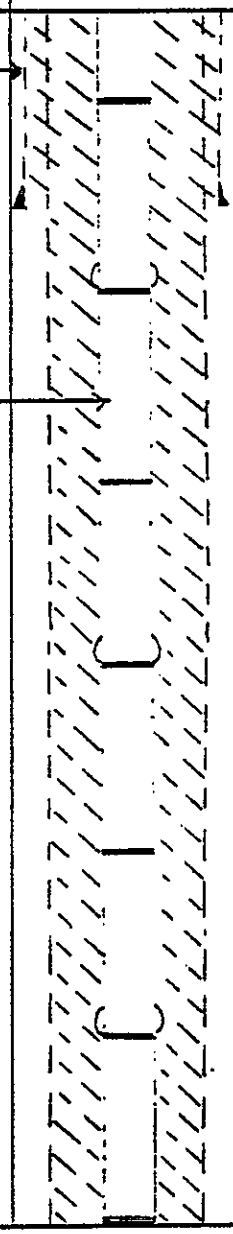
9330010.0451

Battelle
Pacific Northwest Laboratories

AS-BUILT DIAGRAM

Well Number 299 - E24 - 19 Geologist GOODWIN AIRHART LUBSTENT, KENNEDY Page 2 of 3

Reviewed by W. E. McClain Date 12-5-89

Construction Data		Depth in Feet	Geologic/Hydrologic Data	
Description	Diagram		Diagram Litho.	Lithologic Description
151'10" OF 10" CARBON STEEL CASING WITH DRIVE SHOE		135'		SLIGHTLY GRAVELLY SAND
		140'		" " "
		145'		SAND
		150'		SLIGHTLY GRAVELLY SAND
302'6" OF 8" CARBON STEEL CASING		155'		SAND
		160'		"
		165'		"
280.57' OF 4" STAINLESS STEEL CASING		170'		"
		175'		"
		180'		"
		185'		"
		190'		ENCOUNTERED 350-400 GPM @ 187'
		195'		NO CONTAM. DETECTED 191'-194'
		200'		350-400 GPM @ 195'
		205'		NO CONTAM. DETECTED @ 200'
		210'		"
		215'		"
		220'		"
		225'		"
		230'		"
		235'		"
		240'		"
		245'		"
		250'		SLIGHTLY GRAVELLY SAND
		255'		GRAVELLY SAND
		260'		SAND

A-1800-186 (3/87)

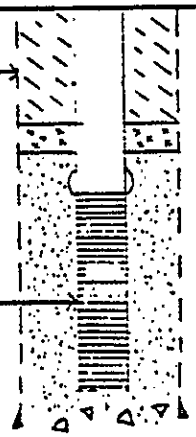
8930018.1167

Battelle
Pacific Northwest Laboratories

AS-BUILT DIAGRAM

Well Number 299-E24-19 Geologist GOODWIN, AIRHART, LUBRECHT, KENNEDY Page 3 of 3

Reviewed by W.L. McFlan Date 12-5-89

Construction Data		Depth in Feet	Geologic/Hydrologic Data	
Description	Diagram		Diagram Litho.	Lithologic Description
302'6" OF 8" CARBON STEEL CASING W/ DRIVE SHOE		265'		SAND
		270'		"
		275'		"
		280'		MUD
		285'		MUDDY SANDY GRAVEL
21.03' OF 4" STAINLESS STEEL CHANNEL-PACK SCREEN		290'		" " "
		295'		SAND
		298'		SANDY GRAVEL
		303'		" "
				T.D. = 303.19'
				COMPLETION DEPTH = 300.66'

COMPLETION SYMBOLS:

- CEMENT GROUT
- BENTONITE CRUMBLES
- BENTONITE PELLETS
- SILICA SAND
- CASING JOINTS
- CASING CENTRALIZER

A-1600-186 (3/87)

PNL-MA-567 DO-1, REV. 0.

8910180453

Aquifer Test Data

WHC-SD-EN-TI-147, Rev. 0

Data for Well E24-19
Pumping Well —
Observation Wells —

Location 200 East Area, A Tank Farm
Type of Aquifer Test Slug Injection/Withdrawal
How Q Measured —
How W.L.'s Measured Steel tape s/n 2 + Conoid transducer (In Situ)
Rad./Dist. of/From Pumping Well 2"
Meas. Point for W.L.'s Top of 4" casing
Elevation of Meas. Point —

Depth of Pump/Airpipe —
Pump On: date — time —
Pump Off: date — time —
Duration of Aquifer Test —

Time t = ____ at t' = 0					Water Level Data Static Water Level 286.32' below TOC					Discharge		Recorded By	Comments
Day	Clock Time	t	t'	t/t'	Reading	Conversions or Corrections	Water Level	s or s'		Reading	Q		
19	1003				287	-0.68	286.32					D/B = 299.3 + 2.5 = 301.8 from T.	
												TOC	is 0.9' above ground
	1035				Ref = 0 @ 13.63'			Scale = 9.99		offset =	0.0		Step # 8
										Troll sdlr. S/N 259198			
										Data logger			S/N IKB-701
												DRN	
	1040				Drop Slug (Slug hung up - it was totally submerged within 10 sec)								
	1050				Stopped logging data							DRN	
												↓	
					ref = 0 @ 13.67'			Step # = 9				↓	
	1058				Withdraw Slug (pulled it fast just before							end of	cycle)
	1109				Stop logging data							DRN	
					Switch to a different data logger								Datalogger IKB-750
					because all step numbers are filled								
					Step # 0, ref = 0 @ 13.73'			scale = 9.99		offset =	0.0		
	1118				Drop Slug	ref = 0 @ 13.73'				(Slug dropped slowly so it won't bang			
	1129				Stop logging data							DRN	
					Test # 1 ref = 0 @ 13.74'							↓	
	1132				Withdraw Slug (pulled it fast just before							end of	cycle)
	1140				Stop logging data							DRN	
												↓	
	1155				Extracted one bail level water was a little dirty								
										Daniel R. Newcomer 10/2/89			

9230018.0459

Location 200 East Area, A Tank Farm Date of Test 10/2/89

Well Number 299-E24-19 Procedure Number PNL-MA-567 AT-6 Rev 0

Type of Test(s) Slug Injection / Withdrawal

Personnel Conducting Test D.R. Newcomer

WELL CONFIGURATION

Well Depth 300.9' below ground surface Borehole Diameter 8"

Well Casing Inside Diameter 4" Well Screen Inside Diameter 4"

Length of Screened Interval 15.6' (below water) Depth of Screen ~~282'-300'~~ 279.65' to 300.68' below ground DRN 10/26/89

Comments Well is undeveloped

SLUG INFORMATION

Slug Construction Materials Carbon Steel

Length of Slug 8.05' Diameter of Slug 0.24'

Comments

Volume of Attachments (if applicable)

8930018.0455

MEASUREMENT EQUIPMENT INFORMATION

	Make	Model	Serial Number
Electric Tape			
Steel Tape	Lufkin	Super Hi-way Nubian	L300-14
Data logger	In Situ	SE1000B	1KB-701, 1KB-700 (See Aquifer Test Data Sheet)
Transducer	Druck	PTX-161D	259198
Other			

Darrell Newcomer 10/2/89

Equipment Record Form for the Installation and Removal of Data Loggers and Pressure Transducers

Initial Check: ok		
Purpose of Installation: To monitor slug injection/withdrawal test responses		
Monitored Hydrologic Unit or Water Body: Uppermost Unconfined Aquifer (Hanford formation)		
Date/Time of Installation: 10/2/89 1015 hrs.	Procedure Followed: PNL-MA-567 WI-4, Rev 0	
Data Logger Make/Model: In Situ / SE1000B		
Serial No.: 1KB-701 1KB-700	Number of Channels Used: 1	
Pressure Transducer Make/Model: Druck / PTX-161D	Full Scale Range: 10 psi	Well No.: 299-E24-19
	Serial No.: 259198	Depth: ~299' below ground surface
Pressure Transducer Make/Model:	Full Scale Range:	Well No.:
	Serial No.:	Depth:

Description of Data Logger Installation and Well Head Configuration:

Stickup of 4" casing is 0.9' above ground surface

Comments:

Slug was positioned into place above the water before placing the transducer down the well. Switch to a different datalogger—after first set of tests because the step numbers were filled—and ~~control~~ the data could not be dumped in the field (see Aquifer Test Data Sheet).

Equipment Installed By	Darrell Newcomer
Date/Time of Equipment Removal:	10/2/89 1145 hrs.
Decontamination-Procedure (if required):	
Equipment Removed By	Darrell Newcomer

(5/18/89, Rev. 0)

ELECTRONIC DATA CONTROL FORM

DATE AND START TIME OF DATA ACQUISITION 10/2/89, 1040 hrs.

DATE AND END TIME OF DATA ACQUISITION 10/2/89, 1050 hrs.

WELL NUMBER 299-E24-19

TYPE OF TEST OR DATA Slug Test

TYPE AND IDENTIFICATION NUMBER OF DATA LOGGER In Situ Hermit SE1000B Serial # 1KB-701

TEST NUMBER 8

CHANNEL OR INPUT NUMBER 1

UNITS OF VALUES RECORDED feet

NUMBER OF PAGES ATTACHED 2

COMMENTS: Test 8 = Submerge Slug

DATA VALIDATION STATEMENT:

The attached data represent the data as originally recorded on the data logger. Any exceptions and reasons for such are indicated in the comments section.

Darrell Newcomer, Scientist
Name, title

10/3/89
Date

9350018.0157

Well: 299-E24-19
Test Date: October 2, 1989
Start Time: 10:40

SE1000B
Environmental Logger
10/02 15:38

Unit# 00701 Test# 8

INPUT 1: Level (F)

Reference	0.00
Scale factor	9.99
Offset	0.00

Elapsed Time, min	Value, ft
0.0000	0.17
0.0033	0.17
0.0066	0.19
0.0099	0.19
0.0133	0.19
0.0166	0.14
0.0200	0.11
0.0233	0.11
0.0266	0.08
0.0300	0.05
0.0333	0.03
0.0500	0.01
0.0666	0.01
0.0833	0.01
0.1000	0.01
0.1166	0.01
0.1333	0.01
0.1500	0.01
0.1666	0.01
0.1833	0.00
0.2000	- 0.01
0.2166	0.02
0.2333	0.01
0.2500	0.90
0.2666	0.31
0.2833	0.07
0.3000	0.00
0.3166	0.03
0.3333	0.23
0.4167	- 0.00
0.5000	0.03
0.5833	0.02
0.6667	0.01
0.7500	0.01
0.8333	0.02
0.9167	0.01
1.0000	0.02
1.0833	0.02
1.1667	0.02
1.2500	0.01
1.3333	0.02
1.4166	0.01
1.5000	0.01
1.5833	0.02
1.6667	0.02
1.7500	0.02
1.8333	0.01
1.9167	0.02
2.0000	0.02
2.5000	0.02
3.0000	0.02
3.5000	0.02
4.0000	0.02
4.5000	0.02
5.0000	0.02
5.5000	0.02
6.0000	0.02
6.5000	0.03
7.0000	0.03
7.5000	0.03
8.0000	0.03
8.5000	0.03
9.0000	0.03
9.5000	0.03
10.0000	0.03

END

9313018.1455

(5/18/89, Rev. 0)

ELECTRONIC DATA CONTROL FORM

DATE AND START TIME OF DATA ACQUISITION 10/2/89, 1058 hrs.

DATE AND END TIME OF DATA ACQUISITION 10/2/89, 1108 hrs.

WELL NUMBER 299-E24-19

TYPE OF TEST OR DATA Slug Test

TYPE AND IDENTIFICATION NUMBER OF DATA LOGGER In Situ Hermit SE1000B Serial # 1KB-701

TEST NUMBER 9

CHANNEL OR INPUT NUMBER 1

UNITS OF VALUES RECORDED feet

NUMBER OF PAGES ATTACHED 2

COMMENTS: Test 9 = Withdraw Slug

DATA VALIDATION STATEMENT:

The attached data represent the data as originally recorded on the data logger. Any exceptions and reasons for such are indicated in the comments section.

Darrell Newcomer, Scientist
Name, title

10/3/89
Date

8915010.0455

Well: 299-E24-19
Test Date: October 2, 1989
Start Time: 10:58

SE1000B
Environmental Logger
10/02 15:40

Unit# 00701 Test# 9

INPUT 1: Level (F)

Reference	0.00
Scale factor	9.99
Offset	0.00

Elapsed Time, min	Value, ft
0.0000	- 1.60
0.0033	- 1.50
0.0066	- 1.39
0.0099	- 1.31
0.0133	- 1.25
0.0166	- 1.18
0.0200	- 1.10
0.0233	- 1.05
0.0266	- 1.00
0.0300	- 0.95
0.0333	- 0.88
0.0500	- 0.65
0.0666	- 0.46
0.0833	- 0.35
0.1000	- 0.25
0.1166	- 0.17
0.1333	- 0.12
0.1500	- 0.08
0.1666	- 0.05
0.1833	- 0.03
0.2000	- 0.01
0.2166	- 0.00
0.2333	0.00
0.2500	0.00
0.2666	0.00
0.2833	0.01
0.3000	0.01
0.3166	0.01
0.3333	0.02
0.4167	0.02
0.5000	0.02
0.5833	0.02
0.6667	0.02
0.7500	0.01
0.8333	0.01
0.9167	0.01
1.0000	0.02
1.0833	0.02
1.1667	0.02
1.2500	0.02
1.3333	0.02
1.4166	0.02
1.5000	0.02
1.5833	0.02
1.6667	0.02
1.7500	0.02
1.8333	0.02
1.9167	0.02
2.0000	0.02
2.5000	0.02
3.0000	0.02
3.5000	0.02
4.0000	0.02
4.5000	0.02
5.0000	0.02
5.5000	0.02
6.0000	0.02
6.5000	0.02
7.0000	0.02
7.5000	0.03
8.0000	0.03
8.5000	0.02
9.0000	0.02
9.5000	0.02
10.0000	0.02

END

(5/18/89, Rev. 0)

ELECTRONIC DATA CONTROL FORM

DATE AND START TIME OF DATA ACQUISITION 10/2/89, 1118 hrs.

DATE AND END TIME OF DATA ACQUISITION 10/2/89, 1128 hrs.

WELL NUMBER 299-E24-19

TYPE OF TEST OR DATA Slug Test

TYPE AND IDENTIFICATION NUMBER OF DATA LOGGER In Situ Hermit SE1000B Serial # 1KB-700

TEST NUMBER Ø

CHANNEL OR INPUT NUMBER 1

UNITS OF VALUES RECORDED Feet

NUMBER OF PAGES ATTACHED 2

COMMENTS: Test Ø = Submerge Slug

DATA VALIDATION STATEMENT:

The attached data represent the data as originally recorded on the data logger. Any exceptions and reasons for such are indicated in the comments section.

Darrell Newcomer, Scientist
Name, title.

10/3/89
Date

9310012.0068

Well: 299-E24-19
Test Date: October 2, 1989
Start Time: 11:18

SE1000B
Environmental Logger
10/02 15:44

Unit# 00700 Test# 0

INPUT 1: Level (F)

Reference	0.00
Scale factor	9.99
Offset	0.00

Elapsed Time, min	Value, ft
0.0000	0.31
0.0033	0.31
0.0066	0.30
0.0099	0.32
0.0133	0.31
0.0166	0.32
0.0200	0.31
0.0233	0.33
0.0266	0.32
0.0300	0.32
0.0333	0.35
0.0500	0.33
0.0666	0.39
0.0833	0.41
0.1000	0.40
0.1166	0.40
0.1333	0.41
0.1500	0.23
0.1666	0.29
0.1833	0.00
0.2000	0.01
0.2166	0.03
0.2333	0.00
0.2500	- 0.03
0.2666	- 0.08
0.2833	0.09
0.3000	- 0.00
0.3166	0.00
0.3333	0.00
0.4167	0.00
0.5000	0.00
0.5833	0.00
0.6667	0.00
0.7500	0.00
0.8333	0.00
0.9167	0.00
1.0000	0.00
1.0833	0.00
1.1667	0.00
1.2500	0.00
1.3333	0.00
1.4166	0.00
1.5000	0.00
1.5833	0.00
1.6667	0.00
1.7500	0.00
1.8333	0.00
1.9167	0.00
2.0000	0.00
2.5000	0.00
3.0000	0.00
3.5000	0.00
4.0000	0.00
4.5000	0.00
5.0000	0.00
5.5000	0.00
6.0000	0.00
6.5000	0.00
7.0000	0.00
7.5000	0.00
8.0000	0.00
8.5000	0.00
9.0000	0.00
9.5000	0.00
10.0000	0.00

END

9313016.0462

(5/18/89, Rev. 0)

ELECTRONIC DATA CONTROL FORM

DATE AND START TIME OF DATA ACQUISITION 10/2/89, 1132 hrs.

DATE AND END TIME OF DATA ACQUISITION 10/2/89, 1140 hrs.

WELL NUMBER 299-E24-19

TYPE OF TEST OR DATA Slug Test

TYPE AND IDENTIFICATION NUMBER OF DATA LOGGER In Situ
Hermit SE1000B Serial # 1KB-700

TEST NUMBER 1

CHANNEL OR INPUT NUMBER 1

UNITS OF VALUES RECORDED feet

NUMBER OF PAGES ATTACHED 2

COMMENTS:
Test 1 = withdraw slug

DATA VALIDATION STATEMENT:

The attached data represent the data as originally recorded on the data logger. Any exceptions and reasons for such are indicated in the comments section.

Darrell Newcomer, Scientist — Name, title

10/3/89 — Date

9330010.0063

Well: 299-E24-19
Test Date: October 2, 1989
Start Time: 11:32

SE1000B
Environmental Logger
10/02 15:46

Unit# 00700 Test# 1

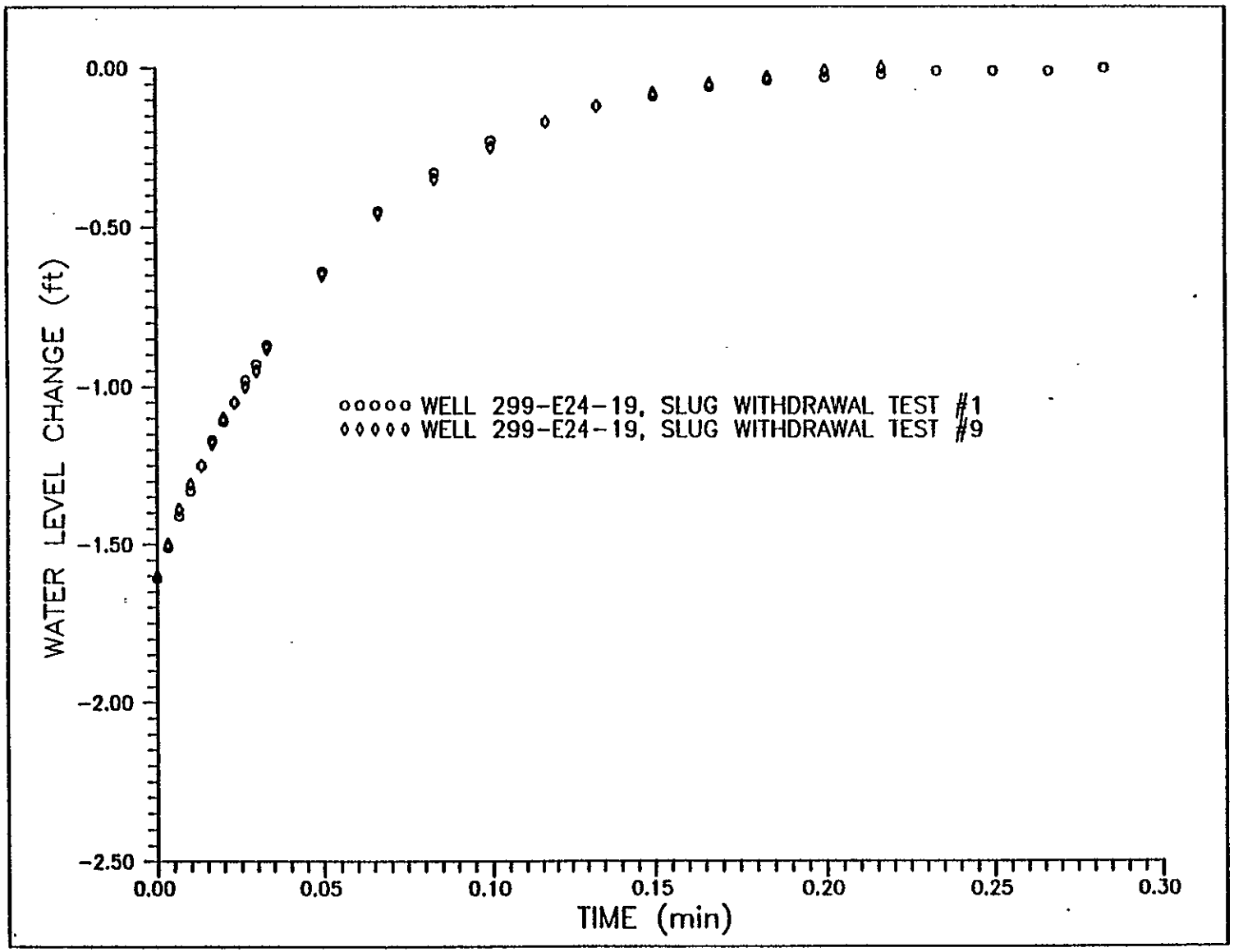
INPUT 1: Level (F)

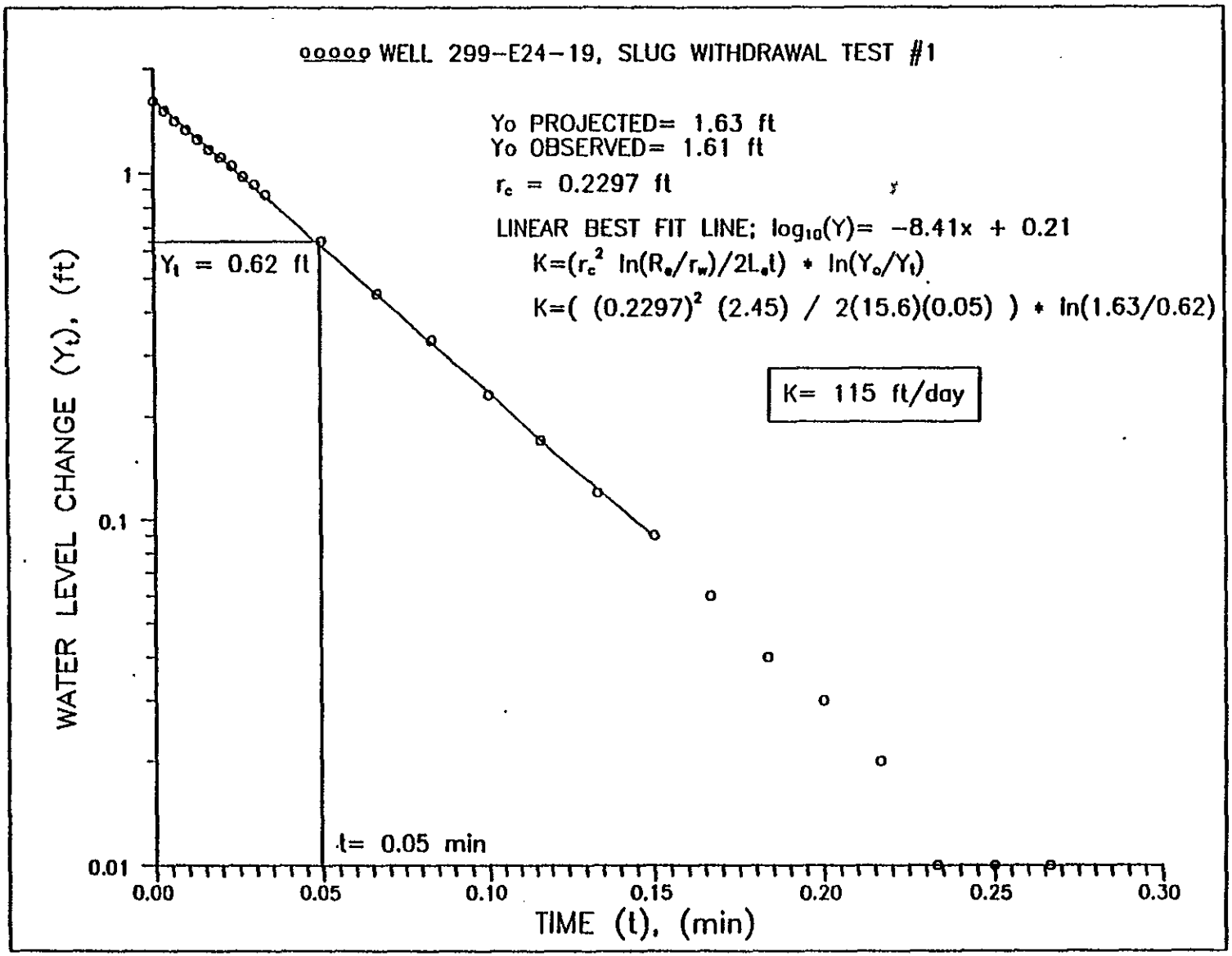
Reference	0.00
Scale factor	9.99
Offset	0.00

Elapsed Time, min	Value, ft
0.0000	- 1.61
0.0033	- 1.51
0.0066	- 1.41
0.0099	- 1.33
0.0133	- 1.25
0.0166	- 1.17
0.0200	- 1.11
0.0233	- 1.05
0.0266	- 0.98
0.0300	- 0.93
0.0333	- 0.87
0.0500	- 0.64
0.0666	- 0.45
0.0833	- 0.33
0.1000	- 0.23
0.1166	- 0.17
0.1333	- 0.12
0.1500	- 0.09
0.1666	- 0.06
0.1833	- 0.04
0.2000	- 0.03
0.2166	- 0.02
0.2333	- 0.01
0.2500	- 0.01
0.2666	- 0.01
0.2833	- 0.00
0.3000	- 0.00
0.3166	- 0.00
0.3333	- 0.00
0.4167	- 0.00
0.5000	- 0.00
0.5833	- 0.00
0.6667	- 0.00
0.7500	- 0.00
0.8333	- 0.00
0.9167	- 0.00
1.0000	- 0.00
1.0833	- 0.00
1.1667	- 0.00
1.2500	- 0.00
1.3333	- 0.00
1.4166	- 0.00
1.5000	- 0.00
1.5833	- 0.00
1.6667	- 0.00
1.7500	- 0.00
1.8333	- 0.00
1.9167	- 0.00
2.0000	- 0.00
2.5000	- 0.00
3.0000	- 0.00
3.5000	- 0.00
4.0000	0.00
4.5000	0.00
5.0000	0.00
5.5000	- 0.00
6.0000	- 0.00
6.5000	0.00
7.0000	- 0.00
7.5000	0.00
8.0000	- 0.00

END

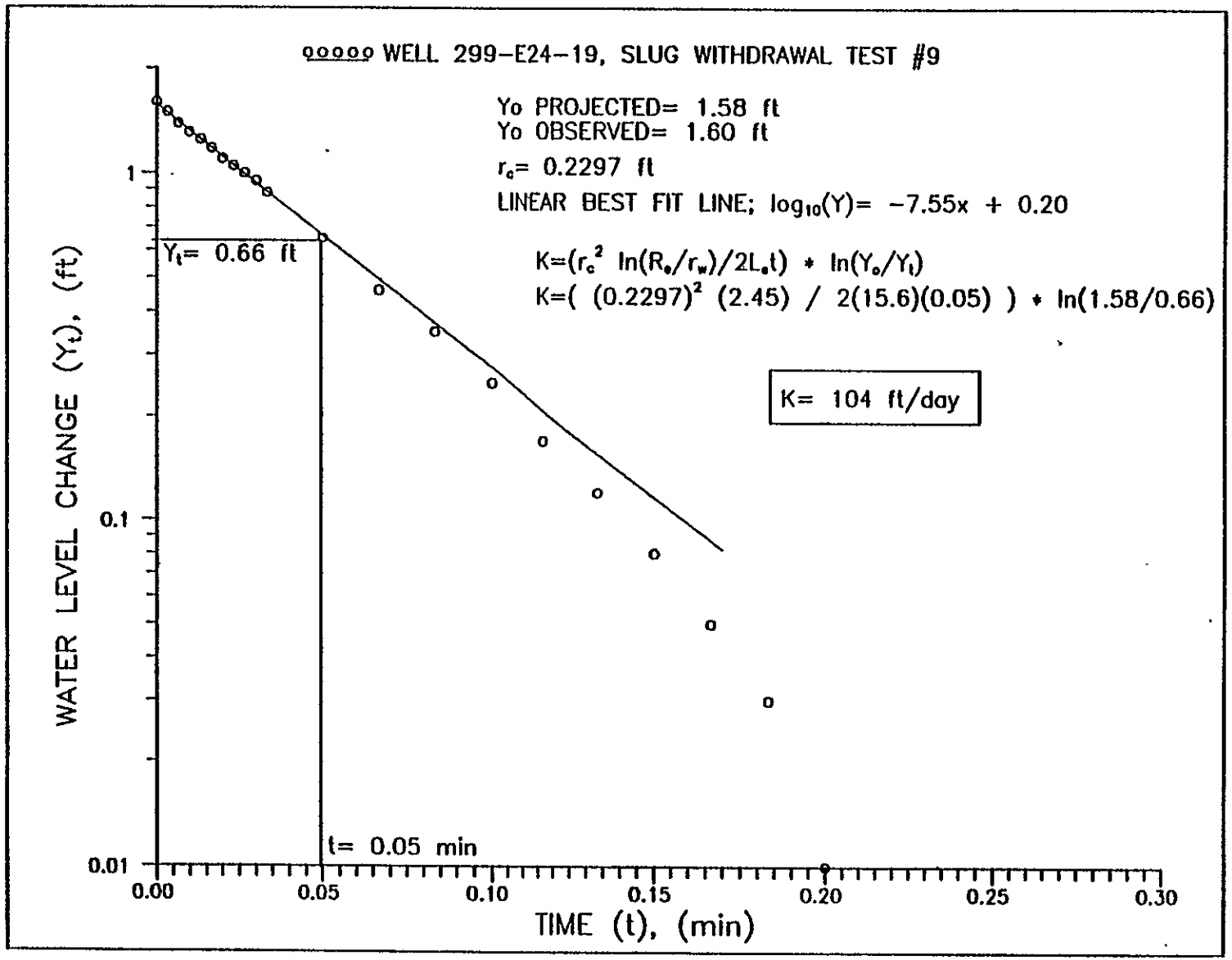
S3501.DAT


WATER LEVEL CHANGE (ft)
0.00
-0.50
-1.00
-1.50
-2.00
-2.50
0.00
0.05
0.10
0.15
0.20
0.25
0.30
TIME (min)
ooooo WELL 299-E24-19, SLUG WITHDRAWAL TEST #1
◊◊◊◊◊ WELL 299-E24-19, SLUG WITHDRAWAL TEST #9


WELL 299-E24-19, SLUG WITHDRAWAL TEST #1
Yo PROJECTED= 1.63 ft
Yo OBSERVED= 1.61 ft
r_c = 0.2297 ft
LINEAR BEST FIT LINE; $\log_{10}(Y)$= -8.41x + 0.21
$K=(r_c^2 \ln(R_e/r_w)/2L_e t) * \ln(Y_o/Y_t)$
$K=((0.2297)^2 (2.45) / 2(15.6)(0.05)) * \ln(1.63/0.62)$
K= 115 ft/day
Y_t = 0.62 ft
t= 0.05 min
WATER LEVEL CHANGE (Y_t), (ft)
TIME (t), (min)
1
0.1
0.01
0.00
0.05
0.10
0.15
0.20
0.25
0.30

```
WELL 299-E24-19, SLUG WITHDRAWAL TEST #1
*****************************************************
 THE BELOW HYDRAULIC CONDUCTIVITY VALUE WAS CALCULATED
 USING THE BOUWER AND RICE SLUG TEST METHOD.
 SOURCE= "THE BOUWER AND RICE SLUG TEST-AN UPDATE"
 GROUND WATER, VOL 27, NO. 3, MAY-JUNE 1989.
 ************************************************
 ************************************************
 RADIUS OF CASING USED IN CALCULATIONS HAS BEEN
 CORRECTED FOR THE THICKNESS OF GRAVEL OR SAND
 PACK DUE TO WATER LEVEL CHANGES IN THE SCREEN OR
 OPEN INTERVAL OF WELL.
 ************************************************
 Rc (ft)    Rw (ft)   Le (ft)    Lw (ft)    H (ft)
 ------------------------------------------------
   .2297     .3333   15.6000     15.6000    95.0000
 ************************************************
 Le/Rw =          46.8000000
 A=          3.0229800
 B=  4.898688E-001
 C=          2.6137240
 SANDPACK POROSITY=  3.000000E-001
 t (min)=  5.000000E-002
 1/t=         20.0000000
 Yo= (ft)           1.6300000
 Yt= (ft)  6.200000E-001
 1/t ln(Yo/Yt)=         19.3323200
 ln[(H-Lw)/Rw]=          5.4731110
 ln(Re/Rw)=          2.4515670
 ************************************************
 K (ft/day) =        115.4481000
 ************************************************
 T OF THE SATURATED SCREEN INTERVAL
 (ft2/day)=       1800.9900000
 ************************************************
```

9830523.0167


WELL 299-E24-19, SLUG WITHDRAWAL TEST #9
Yo PROJECTED= 1.58 ft
Yo OBSERVED= 1.60 ft
r_c= 0.2297 ft
LINEAR BEST FIT LINE; $\log_{10}(Y)$= -7.55x + 0.20
$K=(r_c^2 \ln(R_e/r_w)/2L_e t) * \ln(Y_o/Y_t)$
$K=((0.2297)^2 (2.45) / 2(15.6)(0.05)) * \ln(1.58/0.66)$
K= 104 ft/day
Y_t= 0.66 ft
t= 0.05 min
WATER LEVEL CHANGE (Y_t), (ft)
TIME (t), (min)
1
0.1
0.01
0.00
0.05
0.10
0.15
0.20
0.25
0.30

WELL 299-E24-19, SLUG WITHDRAWAL TEST #9

THE BELOW HYDRAULIC CONDUCTIVITY VALUE WAS CALCULATED
USING THE BOUWER AND RICE SLUG TEST METHOD.
SOURCE= "THE BOUWER AND RICE SLUG TEST-AN UPDATE"
GROUND WATER, VOL 27, NO. 3, MAY-JUNE 1989.

RADIUS OF CASING USED IN CALCULATIONS HAS BEEN
CORRECTED FOR THE THICKNESS OF GRAVEL OR SAND
PACK DUE TO WATER LEVEL CHANGES IN THE SCREEN OR
OPEN INTERVAL OF WELL.

Rc (ft)	Rw (ft)	Le (ft)	Lw (ft)	H (ft)
.2297	.3333	15.6000	15.6000	95.0000

Le/Rw = 46.8000000
A= 3.0229800
B= 4.898688E-001
C= 2.6137240
SANDPACK POROSITY= 3.000000E-001
t (min)= 5.000000E-002
1/t= 20.0000000
Yo= (ft) 1.5800000
Yt= (ft) 6.600000E-001
1/t ln(Yo/Yt)= 17.4588100
ln[(H-Lw)/Rw]= 5.4731110
ln(Re/Rw)= 2.4515670

K (ft/day) = 104.2599000

T OF THE SATURATED SCREEN INTERVAL
(ft2/day)= 1626.4540000

9930118.0469

APPENDIX B

TEST DATA AND ANALYSIS FOR WELL 299-E25-40

9313010.1472

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APPENDIX B

TEST DATA AND ANALYSIS FOR WELL 299-E25-40

This appendix contains the as-built diagram for the well construction, Slug Test Record Form, Aquifer Test Data Sheets, Equipment Record Forms, Electronic Data Control Forms, and accompanying data logs and plots for well 299-E25-40.

0130147

Battelle
Pacific Northwest Laboratories

AS-BUILT DIAGRAM

Well Number 299-E25-40 Geologist M O Lubeck GOODWIN Page 1 of 3

Reviewed by V. L. McGhan Date 12-4-89

Construction Data		Depth in Feet	Geologic/Hydrologic Data	
Description	Diagram		Diagram Litho.	Lithologic Description
143.7' OF 10" CARBON STEEL CASING		5		SAND (Tr. Cobbles)
		10		SAND
CEMENT GROUT		15		SAND
		20		SAND (Tr. Cobbles)
273.1' OF 8" CARBON STEEL CASING		25		"
		30		"
		35		"
		40		SANDY GRAVEL
		45		SAND
FACTORY INSTALLED CENTRALIZERS		50		"
		55		"
253.25' of 4" DIA STAINLESS STEEL CASING		60		"
		65		SLIGHTLY GRAVELLY SAND
		70		SL. GRAVELLY SAND
		75		SANDY GRAVEL
		80		GRAVELLY SAND
		85		GRAVELLY SAND
8-20 BENTONITE		90		GRAVELLY SAND
		95		GRAVELLY SAND
		100		SAND
		105		SAND
		110		SAND
		115		SAND
		120		SAND
		125		SAND
		130		SAND

A-1800-186 (3/87)

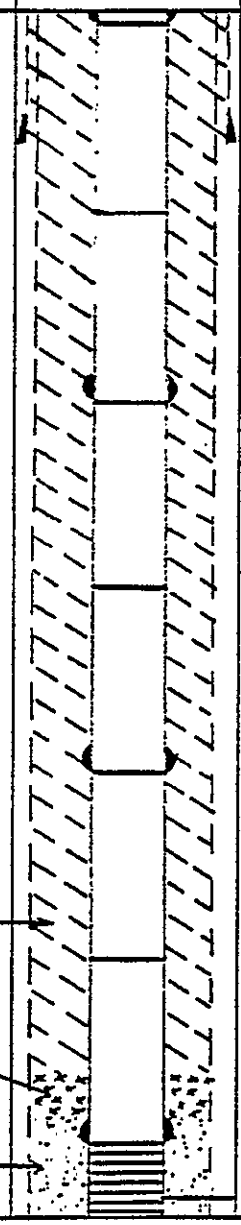
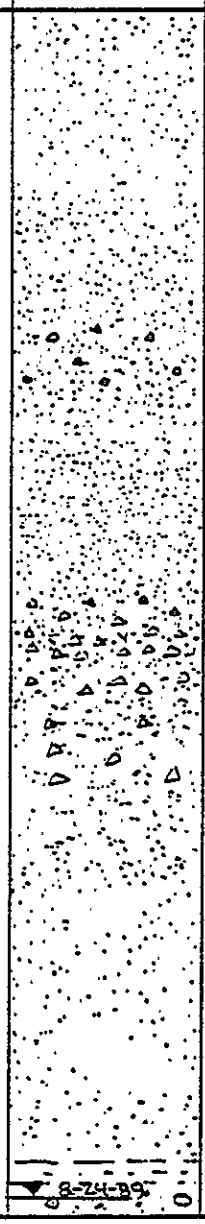
8930818.1477

Battelle
Pacific Northwest Laboratories

AS-BUILT DIAGRAM

Well Number 299-E25-40 Geologist M.O Lobrecht, Goodwin Page 2 of 3

Reviewed by V.L. McGhan Date 12-4-89

Construction Data		Depth in Feet	Geologic/Hydrologic Data	
Description	Diagram		Diagram Litho.	Lithologic Description
10" DIA CARBON STEEL CASING 0'- 143.7'		135		SAND
		140		SAND
		145		SAND
		150		SAND
8" DIA. CARBON STEEL CASING 0'- 273.1'		155		"
		160		"
		165		slightly gravelly SAND
		170		" "
		175		SAND
		180		"
		185		"
		190		"
		195		Sandy GRAVEL
		200		" "
		205		" "
		210		SLIGHTLY GRAVELLY SAND
		215		" " "
		220		SAND
		225		"
8-20 BENTONITE		230		"
		235		"
		240		"
3/8" VOLCLAY TABLETS		245		"
		250		SLIGHTLY MUDDY SAND
16-30 COL. SILICA SAND		255		MUD
		260	8-24-89	SLIGHTLY GRAVELLY SAND

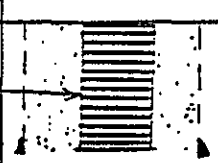
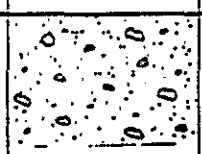
A-1800-186 (3/87)

Battelle
Pacific Northwest Laboratories

AS-BUILT DIAGRAM

Well Number 299-E25-40 Geologist LUBRECHT, GOODWIN Page 3 of 3

Reviewed by W.L. McElroy Date 12-4-89

Construction Data		Depth in Feet	Geologic/Hydrologic Data	
Description	Diagram		Diagram Litho.	Lithologic Description
10-SLOT, STAINLESS STEEL CHANNEL PACK SCREEN -210'		265 270 275	 T.D. 274'	SANDY GRAVEL " "

A-1800-186 (3/87)

9239515.0174

Aquifer Test Data WHC-SD-EN-TI-147, Rev. 0

Data for Well E25-40
Pumping Well –
Observation Wells –

Location 200 East A Tank Farms
Type of Aquifer Test Slug Injection/withdrawal
How Q Measured –
How W.L.'s Measured Steel tape L3a-14, transducer (Insitu)
Rad/Dist of/From Pumping Well 2"
Meas. Point for W.L.'s Top of 4" casing
Elevation of Meas. Point –
Depth of Pump/Airpipe –
Pump On: date – time
Pump Off: date – time
Duration of Aquifer Test –

Time: t = ___ at t' = 0					Water Level Data: Static Water Level 258.13' below TOC					Discharge		Recorded By	Comments
Day	Clock Time	t	t'	t/t'	Reading	Conversions or Corrections	Water Level	s or s'		Reading	Q		Transducer 262361
9/29	13:00				258.13'	Transducer set to bottom of well							Datalogger IKB-701
					274.43	Depth to bottom						WLC	Transducer reading
	13:03				~~16.22~~	← reference on 8D = 0							
	1310				DEN	16.22 is ref, scale = 9.99, offset = 0.0						DAN	Set slug a few inches
					9/29/89								above water
	1311					Slug immersed a couple of seconds late							Slug immersed
					Test #0 dropping slug							WLC	
	13:28				Test #0 stopped								
					Test #1 lift slug								
	~~1~~ 13:36				16.16	reference set to 0							
	1332												Withdraw slug
	1342				Test 1 stopped								
					Test #2 Drop slug								
	1343				16.17	→ reference set to 0							
	1345				slug dropped								
	1355				test 2 stopped								
					test 3 lift slug								
	1356				16.18	reference set to 0							
	1359				slug pulled								
	1410				test 3 stopped								
	1419					Depth to bottom is 271.8' from Top of 4" casing							
						stickup of 4" casing is 1.2' from ground surface							

(Margin notes: done 0; done 1; done 2; done 3)

Darrell Newcomer 9/29/89
William E. Cronin 9/29/89

Location 200 East, A Tank Farm Date of Test 9/29/89

Well Number 299-E25-40 Procedure Number PNL-MA-567 AT-6, Rev 0

Type of Test(s) Slug Injection / Withdrawal

Personnel Conducting Test D.R. Newcomer, Bill Cronin

WELL CONFIGURATION

Well Depth 270.6' below ground surface Borehole Diameter 8"

Well Casing Inside Diameter 4" Well Screen Inside Diameter 4"

Length of Screened Interval 16.1' (below water) Depth of Screen 252'-273'

Comments Well is undeveloped

SLUG INFORMATION

Slug Construction Materials Carbon steel

Length of Slug 8.05' Diameter of Slug 0.24'

Comments

Volume of Attachments (if applicable)

MEASUREMENT EQUIPMENT INFORMATION

	Make	Model	Serial Number	
Electric Tape				
Steel Tape	Lufkin	Super Hiway Nubian	L300-14	
Data logger	In Situ	SE1000B	~~26-361~~	DRN 9/29/89 1KB-701
Transducer	Druck	PTX-161D	262361	
Other				

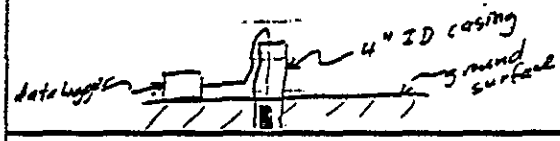
Darrell Newcomer 9/29/89

9320012.1976

Equipment Record Form for the Installation and Removal of Data Loggers and Pressure Transducers

Initial Check: OK		
Purpose of Installation: To monitor slug injection/withdrawal test responses		
Monitored Hydrologic Unit or Water Body: Saturated Screen Interval of Uppermost Unconfined Aquifer (Hanford formation)		
Date/Time of Installation: 9/29/89 1300 hrs.	Procedure Followed: PNL-MA-567 WL-4, Rev 0	
Data Logger Make/Model: In Situ / SE1000B		
Serial No.: 1KB-701	Number of Channels Used: 1	
Pressure Transducer Make/Model: Druck / PTX-161D	Full Scale Range: 10 psi	Well No.: 299-E25-40
	Serial No.: 262361	Depth:
Pressure Transducer Make/Model:	Full Scale Range:	Well No.:
	Serial No.:	Depth:

Description of Data Logger Installation and Well Head Configuration:



Stickup of 4" casing is 1.2 ft. above ground surface

Comments: Slug was positioned into place above the water before placing the transducer down the well.

Equipment Installed By	D.R. Newcomer, Bill Cronin
Date/Time of Equipment Removal:	9/29/89 1415 hrs.
Decontamination Procedure (if required):	
Equipment Removed By	D.R. Newcomer, Bill Cronin

8330210.0173

(5/18/89, Rev. 0)

ELECTRONIC DATA CONTROL FORM

DATE AND START TIME OF DATA ACQUISITION 9/29/89 13:11

DATE AND END TIME OF DATA ACQUISITION 9/29/89 13:27

WELL NUMBER E25-40

TYPE OF TEST OR DATA Slug test

TYPE AND IDENTIFICATION NUMBER OF DATA LOGGER Instru
Hermit 1000B / Serial # 1KB-701

TEST NUMBER 0

CHANNEL OR INPUT NUMBER 1

UNITS OF VALUES RECORDED ft

NUMBER OF PAGES ATTACHED 2

COMMENTS: Test 0 = Submerging Slug

DATA VALIDATION STATEMENT:

The attached data represent the data as originally recorded on the data logger. Any exceptions and reasons for such are indicated in the comments section.

William E Cox, Hydrologist — 10/2/89
Name, title — Date

9330018.0078

Well: 299-E25-40
Test Date: September 29, 1989
Start Time: 13:11

SE1000B
Environmental Logger
09/29 16:22

Unit# 00701 Test# 0

INPUT 1: Level (F)

Reference	0.00
Scale factor	9.99
Offset	0.00

Elapsed Time, min	Value, ft
0.0000	- 0.00
0.0033	- 0.00
0.0066	- 0.00
0.0099	- 0.00
0.0133	- 0.00
0.0166	0.70
0.0200	0.09
0.0233	0.60
0.0266	0.76
0.0300	0.78
0.0333	2.01
0.0500	0.45
0.0666	0.81
0.0833	0.28
0.1000	0.15
0.1166	0.10
0.1333	0.08
0.1500	0.06
0.1666	0.05
0.1833	0.05
0.2000	0.04
0.2166	0.04
0.2333	0.03
0.2500	0.03
0.2666	0.02
0.2833	0.02
0.3000	0.02
0.3166	0.01
0.3333	0.01
0.4167	0.01
0.5000	0.00
0.5833	0.00
0.6667	0.00
0.7500	0.00
0.8333	0.00
0.9167	0.00
1.0000	- 0.00
1.0833	- 0.00
1.1667	- 0.00
1.2500	- 0.00
1.3333	- 0.00
1.4166	- 0.00
1.5000	- 0.00
1.5833	- 0.00
1.6667	- 0.00
1.7500	- 0.00
1.8333	- 0.00
1.9167	- 0.00
2.0000	- 0.01
2.5000	- 0.01
3.0000	- 0.01
3.5000	- 0.02
4.0000	- 0.02
4.5000	- 0.02
5.0000	- 0.02
5.5000	- 0.02
6.0000	- 0.02
6.5000	- 0.02
7.0000	- 0.02
7.5000	- 0.03
8.0000	- 0.03
8.5000	- 0.03
9.0000	- 0.03
9.5000	- 0.03
10.0000	- 0.03
12.0000	- 0.04
14.0000	- 0.04
16.0000	- 0.05

END

9330108.1472

(5/18/89, Rev. 0)

ELECTRONIC DATA CONTROL FORM

DATE AND START TIME OF DATA ACQUISITION 9/29/89 13:31

DATE AND END TIME OF DATA ACQUISITION 9/29/89 13:41

WELL NUMBER E25-40

TYPE OF TEST OR DATA Slug Test

TYPE AND IDENTIFICATION NUMBER OF DATA LOGGER In Situ Hermit 1000B, Serial # 1KB-701

TEST NUMBER 1

CHANNEL OR INPUT NUMBER 1

UNITS OF VALUES RECORDED ft

NUMBER OF PAGES ATTACHED 2

COMMENTS: Test 1 = Lifting Slug.

DATA VALIDATION STATEMENT:

The attached data represent the data as originally recorded on the data logger. Any exceptions and reasons for such are indicated in the comments section.

William E Cronin, Hydrologist — 10/2/89

Name, title — Date

Well: 299-E25-40
Test Date: September 29, 1989
Start Time: 13:31

SE1000B
Environmental Logger
09/29 16:25

Unit# 00701 Test# 1

INPUT 1: Level (F)

Reference	0.00
Scale factor	9.99
Offset	0.00

Elapsed Time, min	Value, ft
0.0000	- 1.31
0.0033	- 1.21
0.0066	- 1.10
0.0099	- 1.01
0.0133	- 0.95
0.0166	- 0.91
0.0200	- 0.89
0.0233	- 0.83
0.0266	- 0.79
0.0300	- 0.75
0.0333	- 0.72
0.0500	- 0.59
0.0666	- 0.48
0.0833	- 0.40
0.1000	- 0.34
0.1166	- 0.28
0.1333	- 0.24
0.1500	- 0.20
0.1666	- 0.17
0.1833	- 0.15
0.2000	- 0.13
0.2166	- 0.11
0.2333	- 0.10
0.2500	- 0.08
0.2666	- 0.07
0.2833	- 0.06
0.3000	- 0.05
0.3166	- 0.05
0.3333	- 0.05
0.4167	- 0.02
0.5000	- 0.01
0.5833	- 0.00
0.6667	- 0.00
0.7500	- 0.00
0.8333	0.00
0.9167	0.00
1.0000	0.00
1.0833	0.00
1.1667	0.00
1.2500	0.00
1.3333	0.00
1.4166	0.00
1.5000	0.00
1.5833	0.00
1.6667	0.00
1.7500	0.00
1.8333	0.00
1.9167	0.01
2.0000	0.00
2.5000	0.00
3.0000	0.01
3.5000	0.00
4.0000	0.00
4.5000	0.00
5.0000	0.00
5.5000	0.00
6.0000	0.00
6.5000	0.00
7.0000	0.00
7.5000	0.00
8.0000	0.00
8.5000	0.00
9.0000	0.00
9.5000	0.00
10.0000	0.00

END

9313019.1491

(5/18/89, Rev. 0)

ELECTRONIC DATA CONTROL FORM

DATE AND START TIME OF DATA ACQUISITION 9/29/89 13:45

DATE AND END TIME OF DATA ACQUISITION 9/29/89 13:55

WELL NUMBER E25-40

TYPE OF TEST OR DATA Slug test

TYPE AND IDENTIFICATION NUMBER OF DATA LOGGER Global Hermit 1000B, serial # 1KB-701

TEST NUMBER 2

CHANNEL OR INPUT NUMBER 1

UNITS OF VALUES RECORDED ft

NUMBER OF PAGES ATTACHED 2

COMMENTS: Test 2 = Submerging slug.

DATA VALIDATION STATEMENT:

The attached data represent the data as originally recorded on the data logger. Any exceptions and reasons for such are indicated in the comments section.

William E Cronin, Hydrologist
Name, title

10/2/89
Date

9350010.1482

Well: 299-E25-40
Test Date: September 29, 1989
Start Time: 13:45

SE1000B
Environmental Logger
09/29 16:28

Unit# 00701 Test# 2

INPUT 1: Level (F)

Reference	0.00
Scale factor	9.99
Offset	0.00

Elapsed Time, min	Value, ft
0.0000	0.36
0.0033	0.33
0.0066	0.29
0.0099	0.25
0.0133	0.22
0.0166	0.20
0.0200	0.20
0.0233	0.18
0.0266	0.17
0.0300	0.15
0.0333	0.14
0.0500	0.11
0.0666	0.10
0.0833	0.09
0.1000	0.08
0.1166	0.07
0.1333	0.07
0.1500	0.06
0.1666	0.06
0.1833	0.06
0.2000	0.05
0.2166	0.05
0.2333	0.05
0.2500	0.05
0.2666	0.04
0.2833	0.04
0.3000	0.04
0.3166	0.04
0.3333	0.04
0.4167	0.03
0.5000	0.02
0.5833	0.02
0.6667	0.02
0.7500	0.02
0.8333	0.01
0.9167	0.01
1.0000	0.01
1.0833	0.01
1.1667	0.01
1.2500	0.00
1.3333	0.01
1.4166	0.00
1.5000	0.00
1.5833	0.00
1.6667	0.00
1.7500	0.00
1.8333	0.00
1.9167	0.00
2.0000	0.00
2.5000	0.00
3.0000	0.00
3.5000	0.00
4.0000	0.00
4.5000	0.00
5.0000	0.00
5.5000	0.00
6.0000	0.00
6.5000	0.00
7.0000	0.00
7.5000	0.00
8.0000	0.00
8.5000	0.00
9.0000	0.00
9.5000	0.00
10.0000	0.00

END

8930130.0169

(5/18/89, Rev. 0)

ELECTRONIC DATA CONTROL FORM

DATE AND START TIME OF DATA ACQUISITION 9/29/89 ~~16:30~~ 13:59

DATE AND END TIME OF DATA ACQUISITION 9/29/89 ~~16:40~~ 14:09

WELL NUMBER E25-40

TYPE OF TEST OR DATA Slug test

TYPE AND IDENTIFICATION NUMBER OF DATA LOGGER In Situ Hermit 1000B, serial # 1KB-701

TEST NUMBER 3

CHANNEL OR INPUT NUMBER 1

UNITS OF VALUES RECORDED ft

NUMBER OF PAGES ATTACHED 2

COMMENTS: Test 3 = Lifting Slug

DATA VALIDATION STATEMENT:

The attached data represent the data as originally recorded on the data logger. Any exceptions and reasons for such are indicated in the comments section.

William E. Cronin, Hydrologist — Name, title

10/2/89 — Date

9330019.0484

Well: 299-E25-40
Test Date: September 29, 1989
Start Time: 13:59

SE1000B
Environmental Logger
09/29 16:30

Unit# 00701 Test# 3

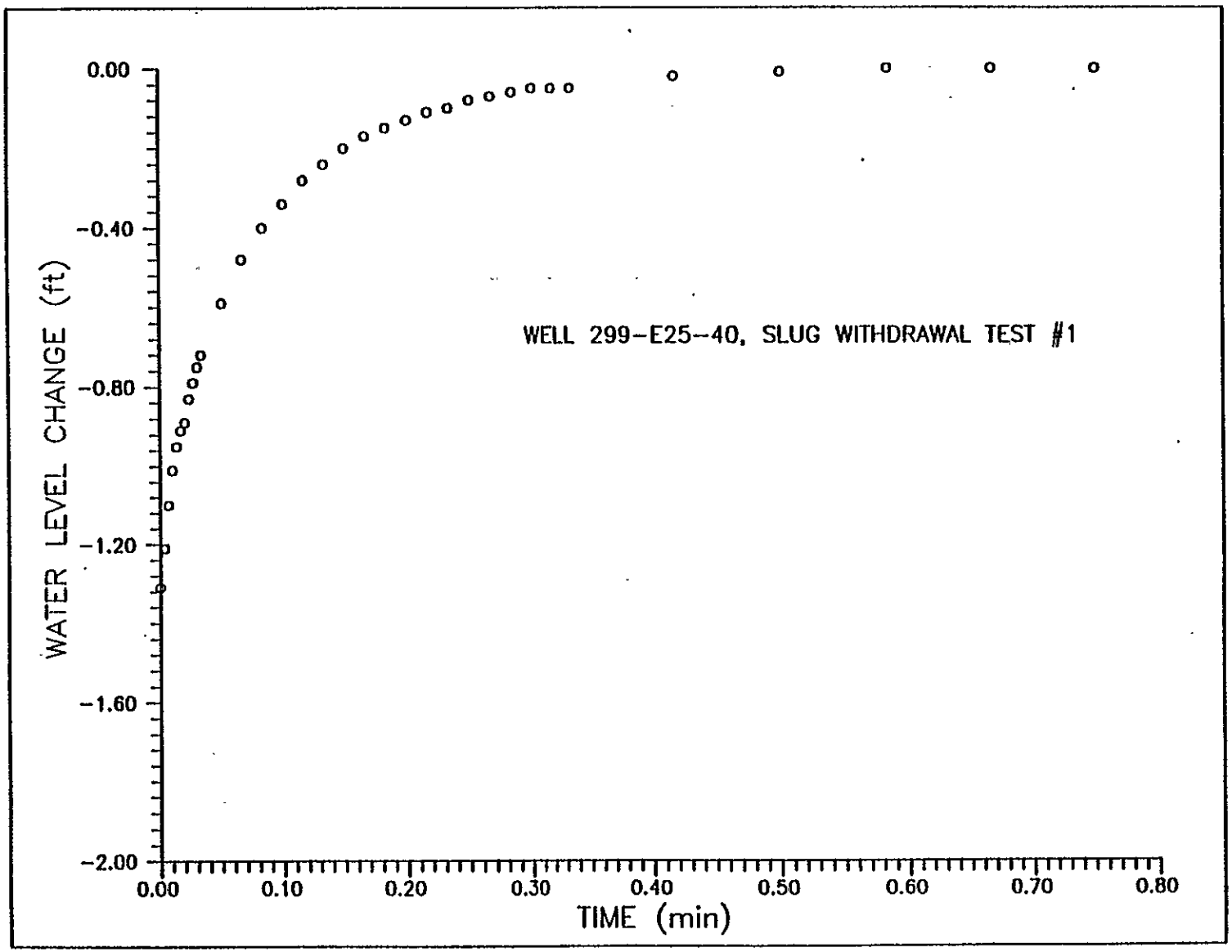
INPUT 1: Level (F)

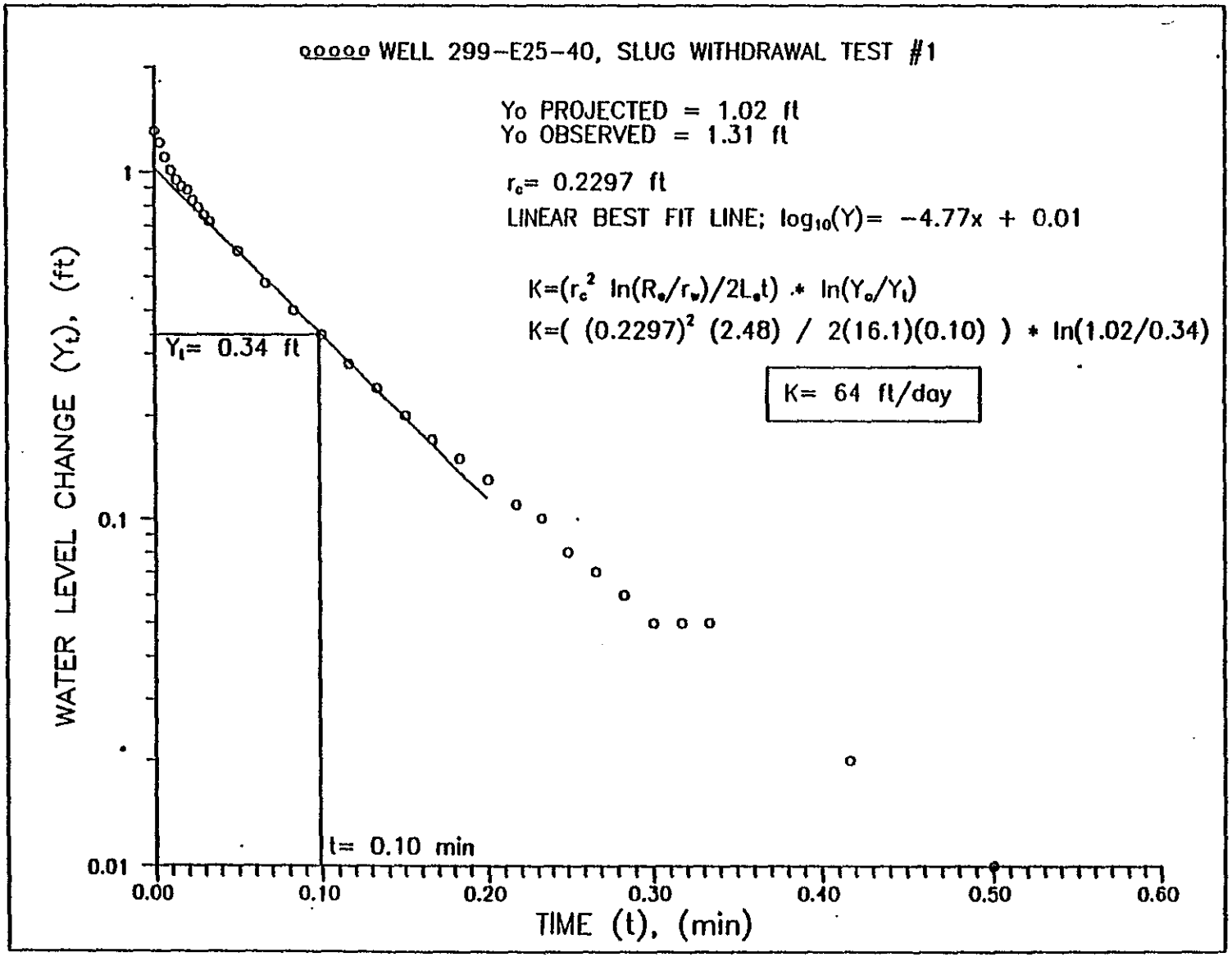
Reference	0.00
Scale factor	9.99
Offset	0.00

Elapsed Time, min	Value, ft
0.0000	- 1.18
0.0033	- 1.08
0.0066	- 0.99
0.0099	- 0.91
0.0133	- 0.84
0.0166	- 0.78
0.0200	- 0.73
0.0233	- 0.69
0.0266	- 0.65
0.0300	- 0.61
0.0333	- 0.58
0.0500	- 0.44
0.0666	- 0.35
0.0833	- 0.28
0.1000	- 0.23
0.1166	- 0.18
0.1333	- 0.15
0.1500	- 0.13
0.1666	- 0.11
0.1833	- 0.09
0.2000	- 0.08
0.2166	- 0.06
0.2333	- 0.06
0.2500	- 0.05
0.2666	- 0.04
0.2833	- 0.04
0.3000	- 0.03
0.3166	- 0.03
0.3333	- 0.03
0.4167	- 0.01
0.5000	- 0.00
0.5833	- 0.00
0.6667	- 0.00
0.7500	0.00
0.8333	0.00
0.9167	0.00
1.0000	0.00
1.0833	0.00
1.1667	0.00
1.2500	0.00
1.3333	0.00
1.4166	0.00
1.5000	0.00
1.5833	0.00
1.6667	0.00
1.7500	0.00
1.8333	0.00
1.9167	0.00
2.0000	0.00
2.5000	0.00
3.0000	0.00
3.5000	0.00
4.0000	0.00
4.5000	0.00
5.0000	0.00
5.5000	0.00
6.0000	0.00
6.5000	0.00
7.0000	0.00
7.5000	0.00
8.0000	0.00
8.5000	0.00
9.0000	0.00
9.5000	0.00
10.0000	0.00

END

9330018.0466


WELL 299-E25-40, SLUG WITHDRAWAL TEST #1
WATER LEVEL CHANGE (ft)
0.00
-0.40
-0.80
-1.20
-1.60
-2.00
0.00
0.10
0.20
0.30
0.40
0.50
0.60
0.70
0.80
TIME (min)


WELL 299-E25-40, SLUG WITHDRAWAL TEST #1
Yo PROJECTED = 1.02 ft
Yo OBSERVED = 1.31 ft
r_c= 0.2297 ft
LINEAR BEST FIT LINE; $\log_{10}(Y)$= -4.77x + 0.01
$K=(r_c^2 \ln(R_e/r_w)/2L_e t) * \ln(Y_o/Y_t)$
$K=((0.2297)^2 (2.48) / 2(16.1)(0.10)) * \ln(1.02/0.34)$
K= 64 ft/day
Y_t= 0.34 ft
t= 0.10 min
WATER LEVEL CHANGE (Y_t), (ft)
TIME (t), (min)
1
0.1
0.01
0.00
0.10
0.20
0.30
0.40
0.50
0.60

WELL 299-E25-40, SLUG WITHDRAWAL TEST #1

THE BELOW HYDRAULIC CONDUCTIVITY VALUE WAS CALCULATED USING THE BOUWER AND RICE SLUG SLUG TEST METHOD.
SOURCE= "THE BOUWER AND RICE SLUG TEST-AN UPDATE"
GROUND WATER, VOL 27, NO. 3, MAY-JUNE 1989.

RADIUS OF CASING USED IN CALCULATIONS HAS BEEN CORRECTED FOR THE THICKNESS OF GRAVEL OR SAND PACK DUE TO WATER LEVEL CHANGES IN THE SCREEN OR OPEN INTERVAL OF WELL.

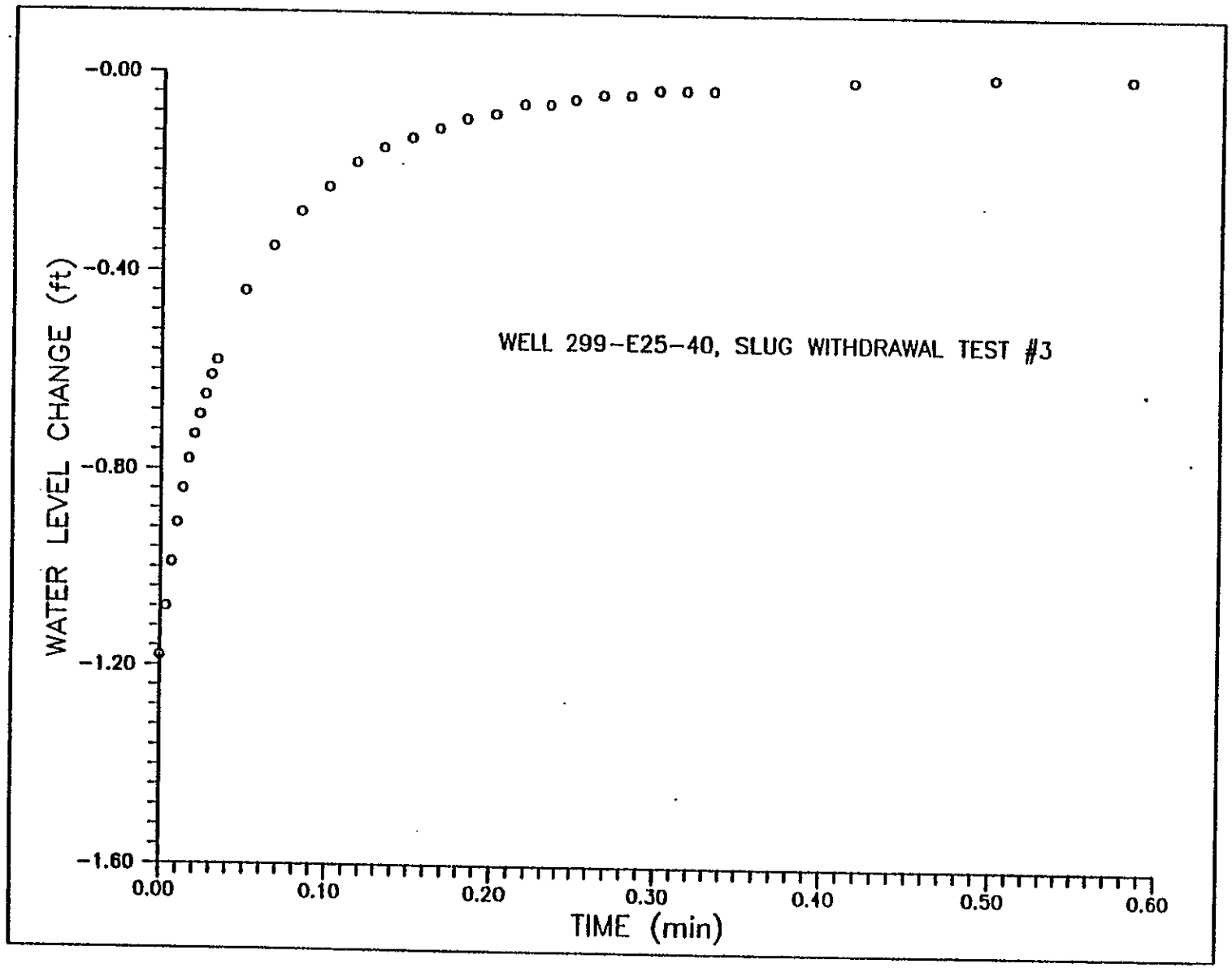
Rc (ft)	Rw (ft)	Le (ft)	Lw (ft)	H (ft)
.2297	.3333	16.1000	16.1000	95.0000

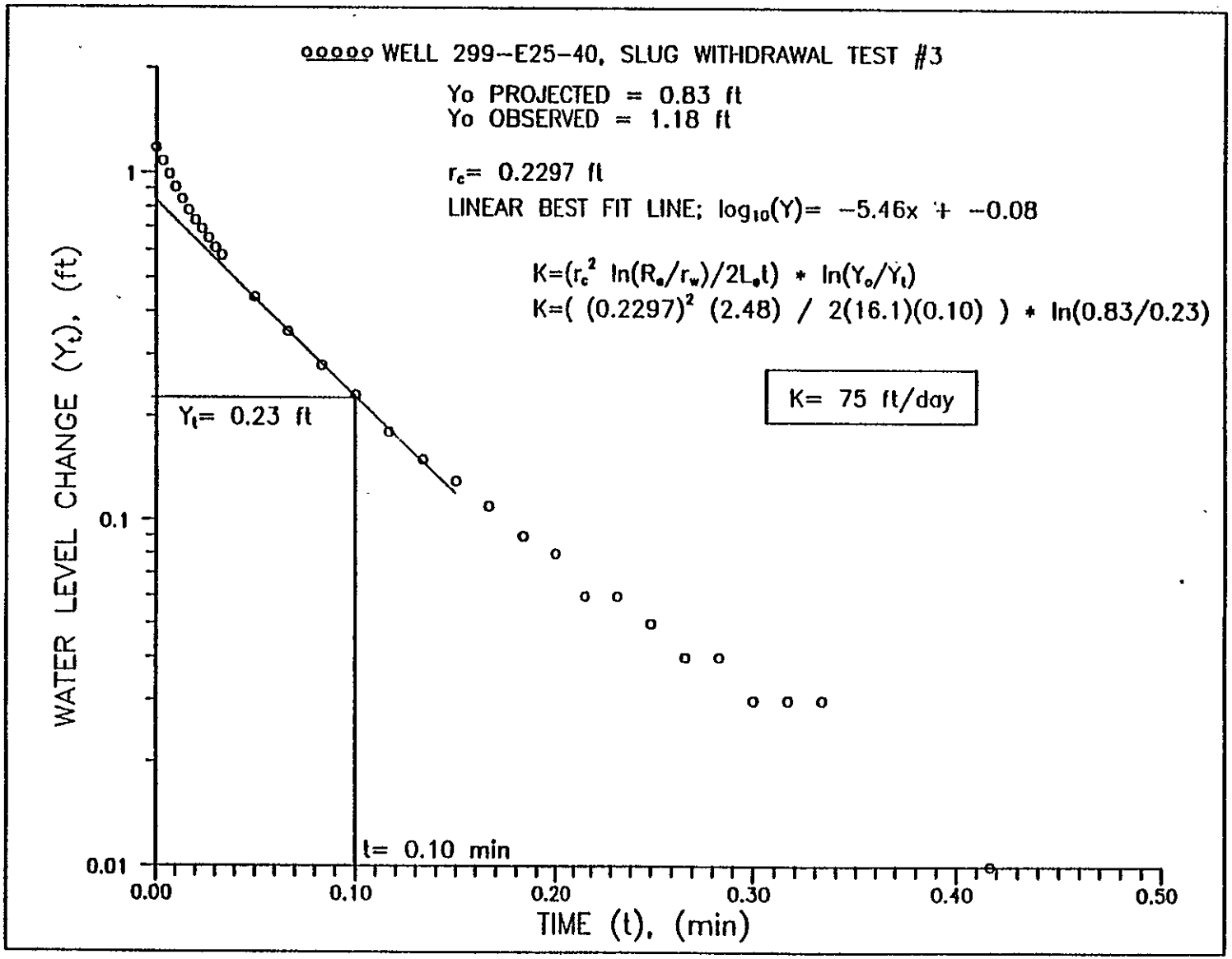
Le/Rw = 48.3000000
A= 3.0530930
B= 4.990199E-001
C= 2.6454010
SANDPACK POROSITY= 3.000000E-001
t (min)= 1.000000E-001
1/t= 10.0000000
Yo= (ft) 1.0200000
Yt= (ft) 3.400000E-001
1/t ln(Yo/Yt)= 10.9861200
ln[(H-Lw)/Rw]= 5.4667940
ln(Re/Rw)= 2.4790210

K (ft/day) = 64.2809700

T OF THE SATURATED SCREEN INTERVAL
(ft2/day)= 1034.9240000

8911310126 891129 PDR


WELL 299-E25-40, SLUG WITHDRAWAL TEST #3
WATER LEVEL CHANGE (ft)
-0.00
-0.40
-0.80
-1.20
-1.60
0.00
0.10
0.20
0.30
0.40
0.50
0.60
TIME (min)


WELL 299--E25-40, SLUG WITHDRAWAL TEST #3
Yo PROJECTED = 0.83 ft
Yo OBSERVED = 1.18 ft
r_c= 0.2297 ft
LINEAR BEST FIT LINE; $\log_{10}(Y)$= -5.46x + -0.08
$K=(r_c^2 \ln(R_e/r_w)/2L_e t) * \ln(Y_o/Y_t)$
$K=((0.2297)^2 (2.48) / 2(16.1)(0.10)) * \ln(0.83/0.23)$
K= 75 ft/day
Y_t= 0.23 ft
t= 0.10 min
WATER LEVEL CHANGE (Y_t), (ft)
TIME (t), (min)
1
0.1
0.01
0.00
0.10
0.20
0.30
0.40
0.50

WELL 299-E25-40, SLUG WITHDRAWAL TEST #3

THE BELOW HYDRAULIC CONDUCTIVITY VALUE WAS CALCULATED
USING THE BOUWER AND RICE SLUG TEST METHOD.
SOURCE= "THE BOUWER AND RICE SLUG TEST-AN UPDATE"
GROUND WATER, VOL 27, NO. 3, MAY-JUNE 1989.

RADIUS OF CASING USED IN CALCULATIONS HAS BEEN
CORRECTED FOR THE THICKNESS OF GRAVEL OR SAND
PACK DUE TO WATER LEVEL CHANGES IN THE SCREEN OR
OPEN INTERVAL OF WELL.

Rc (ft)	Rw (ft)	Le (ft)	Lw (ft)	H (ft)
.2297	.3333	16.1000	16.1000	95.0000

Le/Rw = 48.3000000
A= 3.0530930
B= 4.990199E-001
C= 2.6454010
SANDPACK POROSITY= 3.000000E-001
t (min)= 1.000000E-001
1/t= 10.0000000
Yo= (ft) 8.300000E-001
Yt= (ft) 2.300000E-001
1/t ln(Yo/Yt)= 12.8334600
ln[(H-Lw)/Rw]= 5.4667940
ln(Re/Rw)= 2.4790210

K (ft/day) = 75.0899400

T OF THE SATURATED SCREEN INTERVAL
(ft2/day)= 1208.9480000

9313013.0164

APPENDIX C

TEST DATA AND ANALYSIS FOR WELL 299-E25-41

9330018.1025

APPENDIX C

TEST DATA AND ANALYSIS FOR WELL 299-E25-41

This appendix contains the as-built diagram for the well construction, Slug Test Record Form, Aquifer Test Data Sheets, Equipment Record Forms, Electronic Data Control Forms, and accompanying data logs and plots for well 299-E25-41.

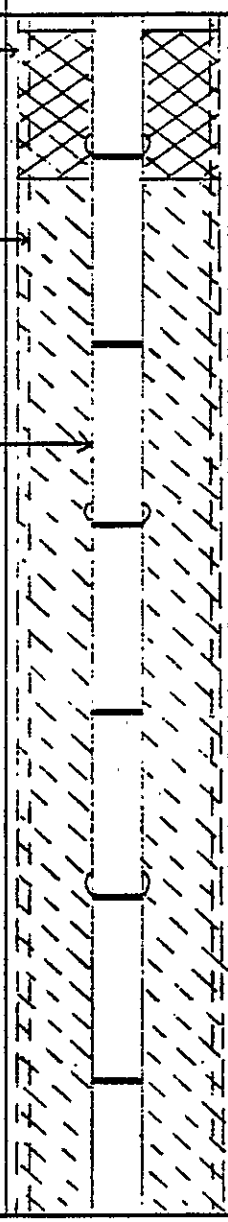
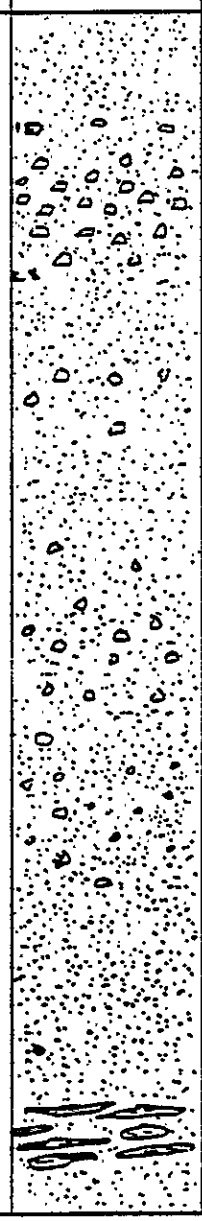
9343018.1429

Battelle
Pacific Northwest Laboratories

AS-BUILT DIAGRAM

Well Number 299-E25-41 Geologist M. Lubeck Page 1 of 4

Reviewed by W. E. Lumbar Date 12-7-89

Construction Data		Depth in Feet	Geologic/Hydrologic Data	
Description	Diagram		Diagram Litho.	Lithologic Description
10" CARBON STEEL CASING		5		SAND
0 – 136'7½" (TEMPORARY)		10		SAND
		15		Sl. Muddy SAND
		20		Sandy GRAVEL
290'3" of 8" CARBON		25		Sandy GRAVEL
STEEL CASING		30		SAND
		35		SAND
		40		Muddy Sandy GRAVEL
257.43' 4" STAINLESS		45		Sl. Gravelly SAND
STEEL CASING		50		SAND
		55		SAND
		60		Sl Gravelly SAND
		65		Sl. Gravelly SAND
		70		Gravelly SAND
		75		Gravelly SAND
		80		Sl. Gravelly SAND
		85		Gravelly SAND
		90		Gravelly SAND
		95		Gravelly SAND
		100		SAND
		105		SAND
		110		SAND
		115		SAND
		120		Interbedded SAND & muddy SAND
		125		Interbedded SAND & muddy SAND
		130		SAND

A-1800-186 (3/87)

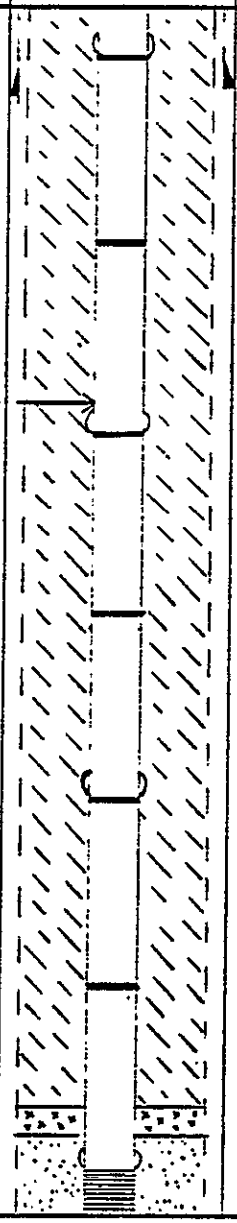
8912210154

Battelle
Pacific Northwest Laboratories

AS-BUILT DIAGRAM

Well Number 299 - E25 - 41 Geologist M. LUBRECHT Page 2 of 3

Reviewed by V.G. McGee Date 12-7-89

Construction Data		Depth in Feet	Geologic/Hydrologic Data	
Description	Diagram		Diagram Litho.	Lithologic Description
139 '7 1/2" OF 10" CARBON STEEL CASING		135		SAND
		140		"
		145		"
280 '3" OF 8" CARBON STEEL CASING		150		"
		155		"
		160		"
		165		"
257.43' OF 4" STAINLESS STEEL CASING		170		"
		175		"
		180		slightly Gravelly SAND
		185		" " "
		190		SAND
		195		"
		200		Sandy GRAVEL
		205		Sandy GRAVEL
		210		gravelly SAND
		215		" "
		220		MUDDY SANDY GRAVEL
		225		" " "
		230		GRAVELLY SAND
		235		" "
		240		" "
		245		" "
		250		" "
		255		SANDY MUD
		260		" "

A-1800-186 (3/87)

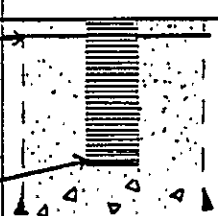
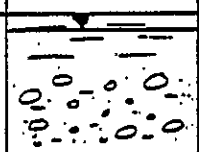
9330018.1405

Battelle
Pacific Northwest Laboratories

AS-BUILT DIAGRAM

Well Number 299-E25-41 Geologist M. LUBRECHT Page 3 of 3

Reviewed by W.E. McClain Date 12-7-89

Construction Data		Depth in Feet	Geologic/Hydrologic Data	
Description	Diagram		Diagram Litho.	Lithologic Description D/W @ 262.24 9-22-89
280' 3" of 6" CARBON STEEL CASING		265		SANDY MUD
		270		MUDDY SANDY GRAVEL
		275		SANDY GRAVEL
21.01' of 4" CHANNEL PACK SCREEN (10 SLOT)				
COMPLETION SYMBOLS:				
CEMENT GROUT				
BENTONITE CRUMBLES				
BENTONITE PELLETS				
SILICA SAND				
CASING JOINT				
CASING CENTRALIZER				

A-1800-156 (3/87)

9213018.0136

Aquifer Test Data WHC-SD-EN-TI-147, Rev. 0

page 1 of 1

Data for Well 2-EL5

Pumping Well —

Observation Wells —

Location 200 East A Tank Farms

Type of Aquifer Test Slug Injection/withdrawal

How Q Measured —

How W.L.'s Measured Steel tape L300-14, transducer (in situ) Depth of Pump/Airpipe —

Rad. Dist. of From Pumping Well 2" Pump On: date — time —

Meas. Point for W.L.'s top of 4" casing Pump Off: date — time —

Elevation of Meas. Point — Duration of Aquifer Test —

Top of 4" casing is 5.2' above ground surface

Time t = ____ at t' = 0					Water Level Data Static Water Level 267.41 from TOC				Discharge		Recorded By	Comments
Day	Clock Time	t	t'	t/t'	Reading	Conversions or Corrections	Water Level	s or s'	Reading	Q		
9/29	1433				267.41						DRN	
1	1442				14.11							Transducer reading
				Drop	slug at Test #4							
	1445				Bottom of slug set at 265' from TOC							
	1446				Ref = 0 @ 14.03'							
	1450				Slug is dropped (couple seconds late)							
	1501				Test #4 stopped						↓	
					Test #5 Pull slug						(we	
	1502				14.02 → Reference set to 0							
	1505				slug pulled							
	1515				test stopped							
					Serial # transducer →							262361
↓					Serial # Data Logger →							1KB-701
10/2					Reset slug into position (1 foot above static)						XD	Cable got caught on slug
10/2					Ref set to 0 @ 13.86'			Test #6			DRN	
	0826				Drop Slug at log 1							
	0836				Stop logging data							
					Set Ref = 0 @ 13.37'			Test #7			↓	
	0840					Withdraw Slug (Pulled it out fast					right	out log 1 cycle)
	0848				Stop logging data						DRN	
↓					T/B is 279.0' from top of casing						↓	
					Darrell Mencones							10/2/89
					Kathleen E. Crowley							10/3/89

93130010402

Location 200 East A-Tank Farm Date of Test 9-29-89, 10-2-89

Well Number 299-E25-41 Procedure Number PNL-MA-567 AT-6, Rev 0

Type of Test(s) Slug Injection / Withdrawal

Personnel Conducting Test Darrell Newcomer, Bill Cronin

WELL CONFIGURATION

Well Depth 273.8' Borehole Diameter 8"

Well Casing Inside Diameter 4" Well Screen Inside Diameter 4"

Length of Screened Interval 13.8' (below water) Depth of Screen 255'-276'

Comments Cable connecting transducer to data logger got pinched by slug before conducting slug tests on 10/2/89. Well is undeveloped

SLUG INFORMATION

Slug Construction Materials Carbon steel

Length of Slug 8.05' Diameter of Slug 0.24'

Comments

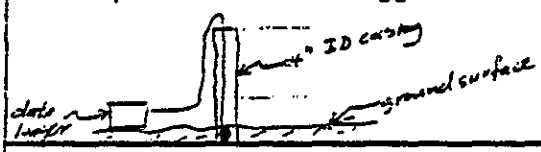
Volume of Attachments (if applicable)

MEASUREMENT EQUIPMENT INFORMATION

	Make	Model	Serial Number
Electric Tape			
Steel Tape	Lufkin	Super Hi-way Nubian	L300-14
Data logger	In Situ	SE1000 B	1KB-701
Transducer	Druck	PTX-161D	262361
Other			

Darrell Newcomer 10/2/89

Equipment Record Form for the Installation and Removal of Data Loggers and Pressure Transducers

Initial Check: ok		
Purpose of Installation: To monitor slug injection / withdrawal test responses		
Monitored Hydrologic Unit or Water Body: Uppermost Unconfined Aquifer (Hanford formation)		
Date/Time of Installation: 9/29/89 1430 hrs.	Procedure Followed: PNL-MA-567 WL-4, Rev 0	
Data Logger Make/Model: In Situ / SE1000 B		
Serial No.: 1KB-701	Number of Channels Used: 1	
Pressure Transducer Make/Model: Druck / PTX-161D	Full Scale Range: 10 psi	Well No.: 299-E25-41
	Serial No.: 262361	Depth: ~276' below ground surface
Pressure Transducer Make/Model:	Full Scale Range:	Well No.:
	Serial No.:	Depth:
Description of Data Logger Installation and Well Head Configuration:  Stickup of 4" casing is 5.2 ft above ground surface		
Comments: Slug was positioned into place above the water before placing the transducer down the well. ~~Slug~~ Transducer had to be repositioned during tests on 10/2/89 because slug pinched cable. Transducer and slug had to be taken out of well and reset. DRN 10/2/89		
Equipment Installed By D. R Newcomer, Bill Cronin		
Date/Time of Equipment Removal: 10/2/89 0900 hrs.		
Decontamination Procedure (if required):		
Equipment Removed By D. R. Newcomer, Bill Cronin		

(5/18/89, Rev. 0)

ELECTRONIC DATA CONTROL FORM

DATE AND START TIME OF DATA ACQUISITION 9/29/89, 14:50

DATE AND END TIME OF DATA ACQUISITION 9/27/89, 15:00

WELL NUMBER E25-41

TYPE OF TEST OR DATA Slug Test

TYPE AND IDENTIFICATION NUMBER OF DATA LOGGER In Situ Hermit 1000B, Serial # 1KB-701

TEST NUMBER 4

CHANNEL OR INPUT NUMBER 2

UNITS OF VALUES RECORDED ft

NUMBER OF PAGES ATTACHED 2

COMMENTS: Test 4 = Submerging slug.

DATA VALIDATION STATEMENT:

The attached data represent the data as originally recorded on the data logger. Any exceptions and reasons for such are indicated in the comments section.

William E Irwin, Hydrologist — Name, title

10/2/89 — Date

9130B.1500

Well: 299-E25-41
Test Date: September 29, 1989
Start Time: 14:50

SE1000B
Environmental Logger
09/29 16:33

Unit# 00701 Test# 4

INPUT 1: Level (F)

Reference	0.00
Scale factor	9.99
Offset	0.00

Elapsed Time, min	Value, ft
0.0000	0.94
0.0033	0.83
0.0066	0.74
0.0099	0.67
0.0133	0.61
0.0166	0.56
0.0200	0.51
0.0233	0.46
0.0266	0.42
0.0300	0.39
0.0333	0.36
0.0500	0.24
0.0666	0.17
0.0833	0.12
0.1000	0.09
0.1166	0.06
0.1333	0.05
0.1500	0.04
0.1666	0.03
0.1833	0.02
0.2000	0.02
0.2166	0.01
0.2333	0.01
0.2500	0.01
0.2666	0.01
0.2833	0.01
0.3000	0.00
0.3166	0.00
0.3333	0.00
0.4167	0.00
0.5000	0.00
0.5833	0.00
0.6667	0.00
0.7500	0.00
0.8333	0.00
0.9167	0.00
1.0000	0.00
1.0833	0.00
1.1667	0.00
1.2500	0.00
1.3333	- 0.00
1.4166	- 0.00
1.5000	- 0.00
1.5833	- 0.00
1.6667	- 0.00
1.7500	- 0.00
1.8333	- 0.00
1.9167	- 0.00
2.0000	- 0.00
2.5000	- 0.00
3.0000	- 0.00
3.5000	- 0.00
4.0000	- 0.00
4.5000	- 0.00
5.0000	- 0.00
5.5000	- 0.01
6.0000	- 0.01
6.5000	0.00
7.0000	- 0.01
7.5000	- 0.01
8.0000	- 0.01
8.5000	- 0.00
9.0000	- 0.01
9.5000	- 0.01
10.0000	- 0.01

END

RELEASED
09/13/95

(5/18/89, Rev. 0)

ELECTRONIC DATA CONTROL FORM

DATE AND START TIME OF DATA ACQUISITION 9/29/89 ~~16:35~~ 15:05

DATE AND END TIME OF DATA ACQUISITION 9/29/89 16:45 15:10

WELL NUMBER E25-41

TYPE OF TEST OR DATA slug test

TYPE AND IDENTIFICATION NUMBER OF DATA LOGGER In Situ Hermit 1000B, serial # 1KB-701

TEST NUMBER 5

CHANNEL OR INPUT NUMBER 1

UNITS OF VALUES RECORDED ft

NUMBER OF PAGES ATTACHED 2

COMMENTS: Test 5 = lifting slug

DATA VALIDATION STATEMENT:

The attached data represent the data as originally recorded on the data logger. Any exceptions and reasons for such are indicated in the comments section.

William E Cronin / Hydrologist — Name, title

10/2/89 — Date

9330018.1502

Well: 299-E25-41
Test Date: September 29, 1989
Start Time: 15:05

SE1000B
Environmental Logger
09/29 16:35

Unit# 00701 Test# 5

INPUT 1: Level (F)

Reference	0.00
Scale factor	9.99
Offset	0.00

Elapsed Time, min	Value, ft
0.0000	- 4.32
0.0033	- 4.49
0.0066	- 4.34
0.0099	- 4.46
0.0133	- 4.45
0.0166	- 4.38
0.0200	- 4.29
0.0233	- 4.15
0.0266	- 3.94
0.0300	- 3.84
0.0333	- 3.81
0.0500	- 3.63
0.0666	- 3.48
0.0833	- 3.38
0.1000	- 3.29
0.1166	- 3.22
0.1333	- 3.15
0.1500	- 3.10
0.1666	- 3.06
0.1833	- 3.02
0.2000	- 2.98
0.2166	- 2.95
0.2333	- 2.86
0.2500	- 2.83
0.2666	- 2.80
0.2833	- 2.78
0.3000	- 2.76
0.3166	- 2.74
0.3333	- 2.72
0.4167	- 2.65
0.5000	- 2.60
0.5833	- 2.56
0.6667	- 2.55
0.7500	- 2.53
0.8333	- 2.52
0.9167	- 2.51
1.0000	- 2.49
1.0833	- 2.48
1.1667	- 2.48
1.2500	- 2.47
1.3333	- 2.47
1.4166	- 2.46
1.5000	- 2.45
1.5833	- 2.44
1.6667	- 2.43
1.7500	- 2.42
1.8333	- 2.41
1.9167	- 2.40
2.0000	- 2.39
2.5000	- 2.32
3.0000	- 2.23
3.5000	- 2.19
4.0000	- 2.17
4.5000	- 2.14
5.0000	- 2.02
5.5000	- 1.96
6.0000	- 0.03
6.5000	0.00
7.0000	0.00
7.5000	0.00
8.0000	- 0.00
8.5000	- 0.00
9.0000	- 0.00
9.5000	- 0.00
10.0000	- 0.00

END

9318102.1502

(5/18/89, Rev. 0)

ELECTRONIC DATA CONTROL FORM

DATE AND START TIME OF DATA ACQUISITION 10/2/89, 0826 hrs

DATE AND END TIME OF DATA ACQUISITION 10/2/89, 0536 hrs.

WELL NUMBER 299-E25-41

TYPE OF TEST OR DATA Slug Injection Test

TYPE AND IDENTIFICATION NUMBER OF DATA LOGGER In Situ Hermit SE1000B Serial # 1KB-701

TEST NUMBER 6

CHANNEL OR INPUT NUMBER 1

UNITS OF VALUES RECORDED feet

NUMBER OF PAGES ATTACHED 3

COMMENTS: Test 6 = Submerse Slug

DATA VALIDATION STATEMENT:

The attached data represent the data as originally recorded on the data logger. Any exceptions and reasons for such are indicated in the comments section.

Darrell Newcomer, Scientist — Name, title

10/3/89 — Date

9310315.1651

Well: 299-E25-41
Test Date: October 2, 1989
Start Time: 08:26

SE1000B
Environmental Logger
10/02 14:42

Unit# 00701 Test# 6

INPUT 1: Level (F)

Reference	0.00
Scale factor	9.99
Offset	0.00

Elapsed Time, min	Value, ft
0.0000	0.81
0.0033	0.81
0.0066	0.81
0.0099	0.77
0.0133	0.72
0.0166	0.94
0.0200	0.88
0.0233	0.84
0.0266	1.01
0.0300	1.21
0.0333	1.09
0.0500	1.21
0.0666	1.42
0.0833	1.35
0.1000	0.61
0.1166	0.60
0.1333	0.46
0.1500	0.36
0.1666	0.28
0.1833	0.23
0.2000	0.19
0.2166	0.16
0.2333	0.14
0.2500	0.12
0.2666	0.11
0.2833	0.10
0.3000	0.09
0.3166	0.08
0.3333	0.08
0.4167	0.06
0.5000	0.05
0.5833	0.05
0.6667	0.05
0.7500	0.04
0.8333	0.04
0.9167	0.04
1.0000	0.03
1.0833	0.03
1.1667	0.03
1.2500	0.02
1.3333	0.02
1.4166	0.02
1.5000	0.02
1.5833	0.02
1.6667	0.02
1.7500	0.01
1.8333	0.01
1.9167	0.01
2.0000	0.01
2.5000	0.01
3.0000	0.01
3.5000	0.01
4.0000	0.01
4.5000	0.01
5.0000	0.01
5.5000	0.00
6.0000	0.00
6.5000	0.00
7.0000	0.00
7.5000	0.00
8.0000	0.00
8.5000	0.00
9.0000	0.01
9.5000	0.00
10.0000	0.00

END

9215013.DOC

(5/18/89, Rev. 0)

ELECTRONIC DATA CONTROL FORM

DATE AND START TIME OF DATA ACQUISITION 10/2/89, 0840 hrs.

DATE AND END TIME OF DATA ACQUISITION 10/2/89, 0848 hrs.

WELL NUMBER 299-E25-41

TYPE OF TEST OR DATA Slug withdrawal Test

TYPE AND IDENTIFICATION NUMBER OF DATA LOGGER In Situ Hermit SE1000B Serial # 1KB-701

TEST NUMBER 7

CHANNEL OR INPUT NUMBER 1

UNITS OF VALUES RECORDED feet

NUMBER OF PAGES ATTACHED 2

COMMENTS:

Test 7 = Lifting slug

DATA VALIDATION STATEMENT:

The attached data represent the data as originally recorded on the data logger. Any exceptions and reasons for such are indicated in the comments section.

Darrell Newcomer, Scientist
Name, title

10/3/89
Date

9330018.1506

Well: 299-E25-41
Test Date: October 2, 1989
Start Time: 08:40

SE1000B
Environmental Logger
10/02 14:46

Unit# 00701 Test# 7

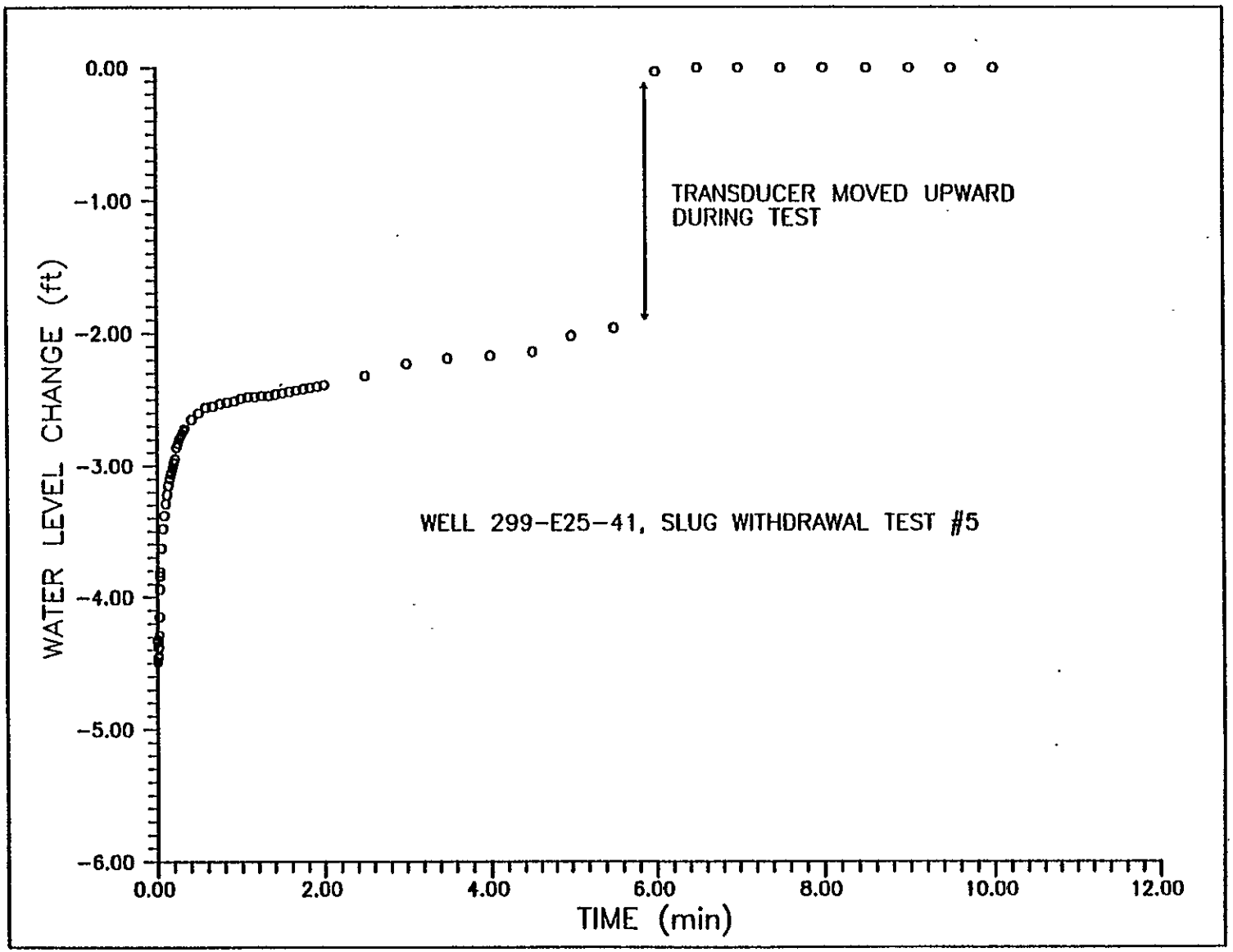
INPUT 1: Level (F)

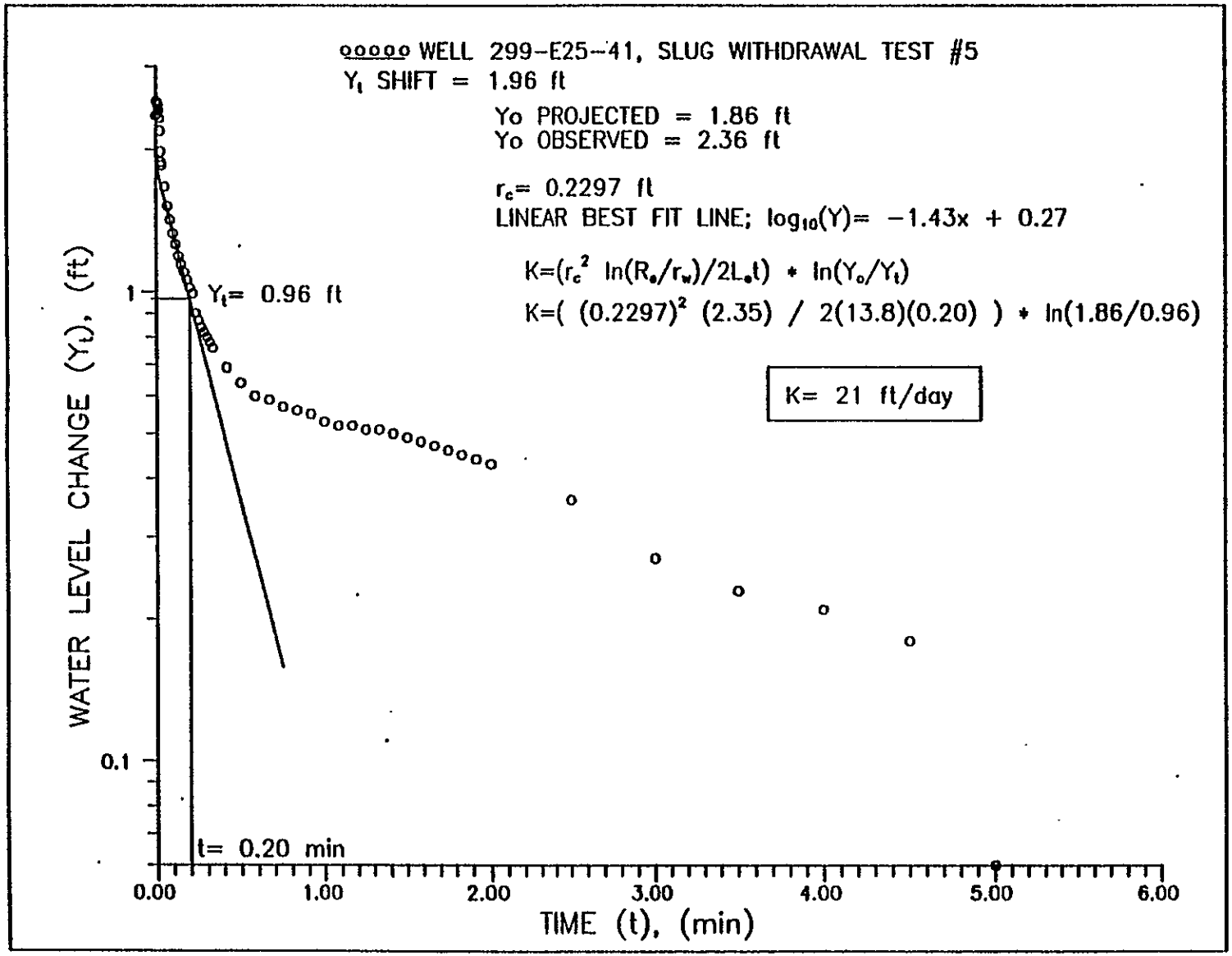
Reference	0.00
Scale factor	9.99
Offset	0.00

Elapsed Time, min	Value, ft
0.0000	- 3.27
0.0033	- 3.27
0.0066	- 3.24
0.0099	- 3.21
0.0133	- 3.06
0.0166	- 3.02
0.0200	- 2.95
0.0233	- 2.93
0.0266	- 2.92
0.0300	- 2.84
0.0333	- 2.81
0.0500	- 2.63
0.0666	- 2.47
0.0833	- 2.32
0.1000	- 2.19
0.1166	- 2.06
0.1333	- 1.93
0.1500	- 1.82
0.1666	- 1.72
0.1833	- 1.62
0.2000	- 1.52
0.2166	- 1.43
0.2333	- 1.34
0.2500	- 1.27
0.2666	- 1.19
0.2833	- 1.12
0.3000	- 1.06
0.3166	- 1.00
0.3333	- 0.95
0.4167	- 0.72
0.5000	- 0.56
0.5833	- 0.45
0.6667	- 0.36
0.7500	- 0.31
0.8333	- 0.26
0.9167	- 0.22
1.0000	- 0.19
1.0833	- 0.16
1.1667	- 0.14
1.2500	- 0.13
1.3333	- 0.11
1.4166	- 0.10
1.5000	- 0.09
1.5833	- 0.08
1.6667	- 0.07
1.7500	- 0.06
1.8333	- 0.06
1.9167	- 0.05
2.0000	- 0.05
2.5000	- 0.02
3.0000	- 0.01
3.5000	- 0.00
4.0000	0.00
4.5000	0.00
5.0000	0.00
5.5000	0.00
6.0000	0.00
6.5000	0.00
7.0000	0.00
7.5000	0.00

END

0094 8106E25


0.00
-1.00
-2.00
-3.00
-4.00
-5.00
-6.00
WATER LEVEL CHANGE (ft)
0.00
2.00
4.00
6.00
8.00
10.00
12.00
TIME (min)
TRANSDUCER MOVED UPWARD
DURING TEST
WELL 299-E25-41, SLUG WITHDRAWAL TEST #5


WELL 299-E25-41, SLUG WITHDRAWAL TEST #5
Yt SHIFT = 1.96 ft
Yo PROJECTED = 1.86 ft
Yo OBSERVED = 2.36 ft
rc= 0.2297 ft
LINEAR BEST FIT LINE; log10(Y)= -1.43x + 0.27
K=(rc² ln(Re/rw)/2Le t) * ln(Yo/Yt)
K=((0.2297)² (2.35) / 2(13.8)(0.20)) * ln(1.86/0.96)
K= 21 ft/day
Yt= 0.96 ft
t= 0.20 min
WATER LEVEL CHANGE (Yt), (ft)
1
0.1
0.00
1.00
2.00
3.00
4.00
5.00
6.00
TIME (t), (min)

WELL 299-E25-41, SLUG WITHDRAWAL TEST #5, Yt SHIFT =1.96 ft

THE BELOW HYDRAULIC CONDUCTIVITY VALUE WAS CALCULATED
USING THE BOUWER AND RICE SLUG TEST METHOD.
SOURCE= "THE BOUWER AND RICE SLUG TEST-AN UPDATE"
GROUND WATER, VOL 27, NO. 3, MAY-JUNE 1989.

RADIUS OF CASING USED IN CALCULATIONS HAS BEEN
CORRECTED FOR THE THICKNESS OF GRAVEL OR SAND
PACK DUE TO WATER LEVEL CHANGES IN THE SCREEN OR
OPEN INTERVAL OF WELL.

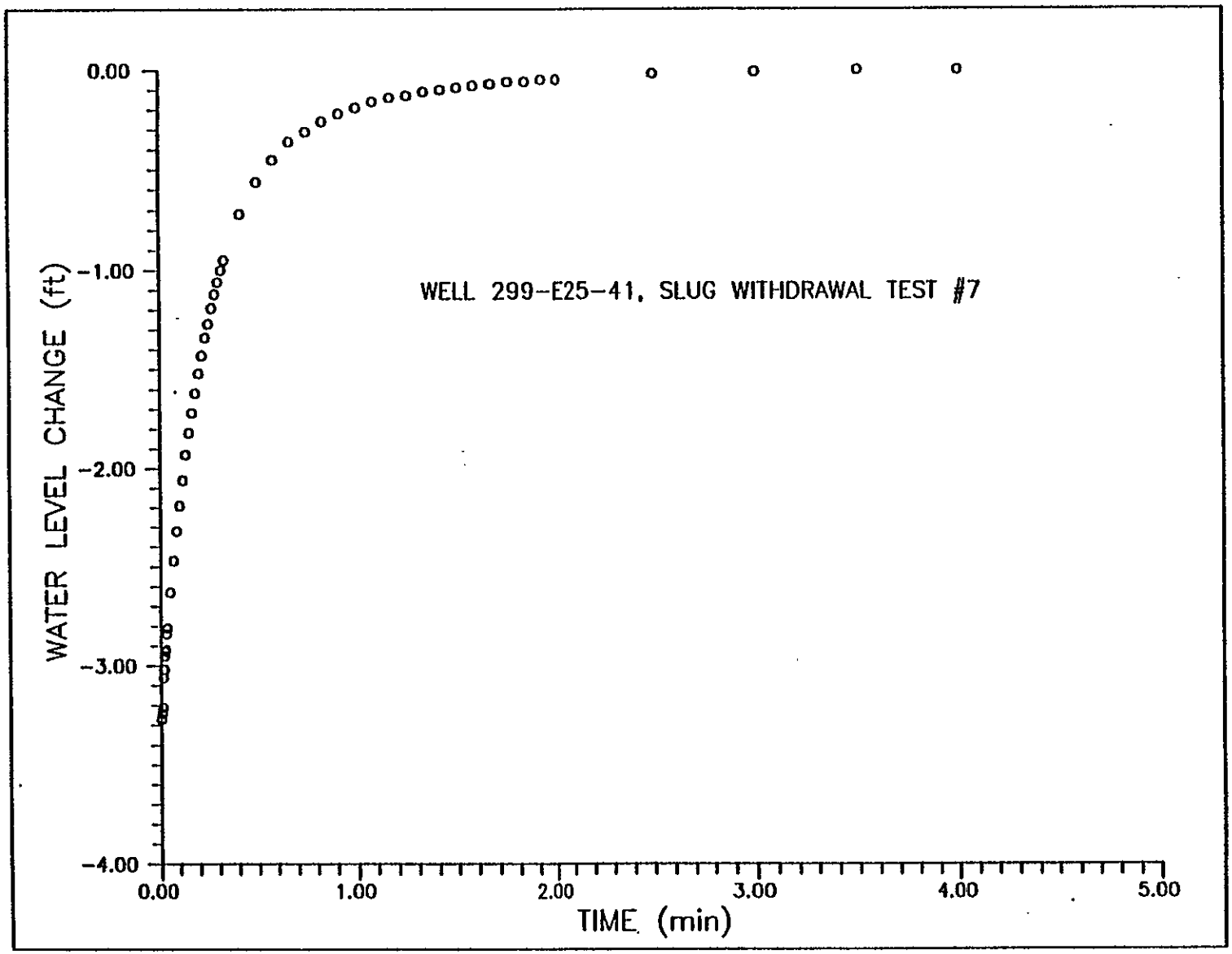
Rc (ft)	Rw (ft)	Le (ft)	Lw (ft)	H (ft)
.2297	.3333	13.8000	13.8000	95.0000

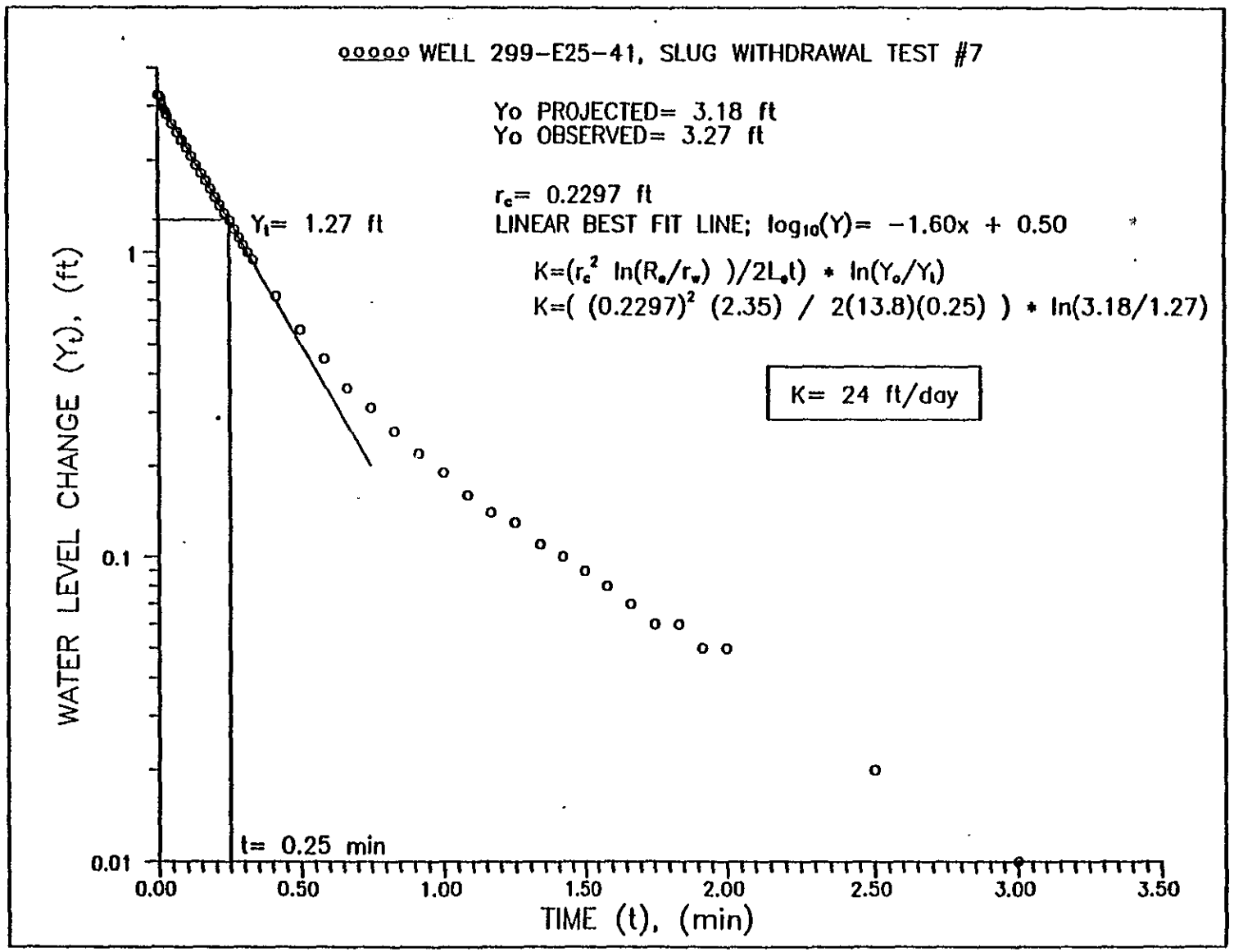
Le/Rw = 41.4000000
A= 2.8792960
B= 4.568365E-001
C= 2.4968560
SANDPACK POROSITY= 3.000000E-001
t (min)= 2.000000E-001
1/t= 5.0000000
Yo= (ft) 1.8600000
Yt= (ft) 9.600000E-001
1/t ln(Yo/Yt)= 3.3069920
ln[(H-Lw)/Rw]= 5.4955270
ln(Re/Rw)= 2.3494690

K (ft/day) = 21.3947600

T OF THE SATURATED SCREEN INTERVAL
(ft2/day)= 295.2477000

B30215


WELL 299-E25-41, SLUG WITHDRAWAL TEST #7
WATER LEVEL CHANGE (ft)
0.00
-1.00
-2.00
-3.00
-4.00
0.00
1.00
2.00
3.00
4.00
5.00
TIME (min)


WELL 299-E25-41, SLUG WITHDRAWAL TEST #7
Yo PROJECTED= 3.18 ft
Yo OBSERVED= 3.27 ft
r_c= 0.2297 ft
Y_t= 1.27 ft
LINEAR BEST FIT LINE; $\log_{10}(Y)$= −1.60x + 0.50
$K=(r_c^2 \ln(R_e/r_w))/2L_e t) * \ln(Y_o/Y_t)$
$K=((0.2297)^2 (2.35) / 2(13.8)(0.25)) * \ln(3.18/1.27)$
K= 24 ft/day
t= 0.25 min
WATER LEVEL CHANGE (Y_t), (ft)
TIME (t), (min)
1
0.1
0.01
0.00
0.50
1.00
1.50
2.00
2.50
3.00
3.50

WELL 299-E25-41, SLUG WITHDRAWAL TEST #7

THE BELOW HYDRAULIC CONDUCTIVITY VALUE WAS CALCULATED
USING THE BOUWER AND RICE SLUG TEST METHOD.
SOURCE= "THE BOUWER AND RICE SLUG TEST-AN UPDATE"
GROUND WATER, VOL 27, NO. 3, MAY-JUNE 1989.

RADIUS OF CASING USED IN CALCULATIONS HAS BEEN
CORRECTED FOR THE THICKNESS OF GRAVEL OR SAND
PACK DUE TO WATER LEVEL CHANGES IN THE SCREEN OR
OPEN INTERVAL OF WELL.

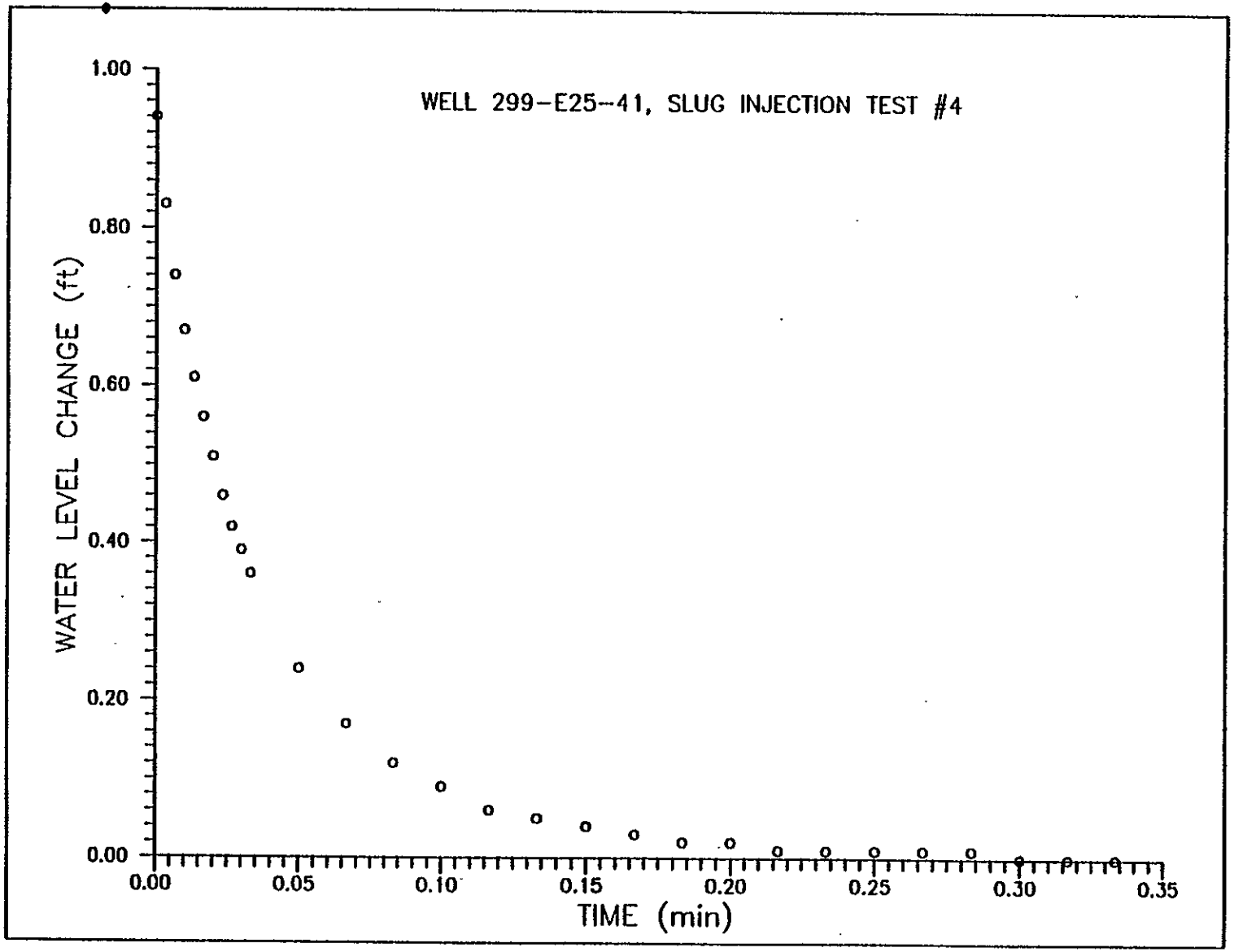
Rc (ft)	Rw (ft)	Le (ft)	Lw (ft)	H (ft)
.2297	.3333	13.8000	13.8000	95.0000

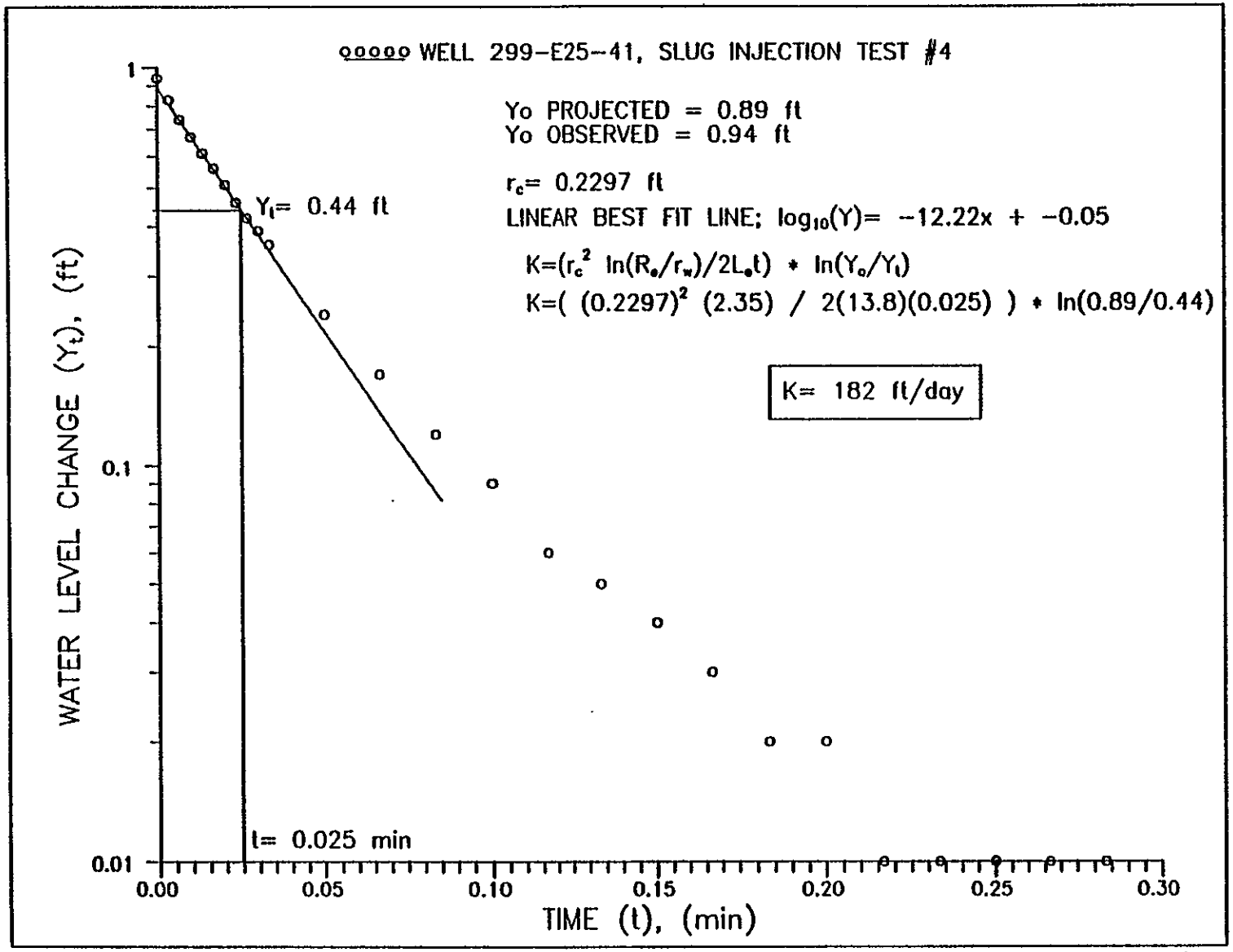
Le/Rw = 41.4000000
A= 2.8792960
B= 4.568365E-001
C= 2.4968560
SANDPACK POROSITY= 3.000000E-001
t (min)= 2.500000E-001
1/t= 4.0000000
Yo= (ft) 3.1800000
Yt= (ft) 1.2700000
1/t ln(Yo/Yt)= 3.6714570
ln[(H-Lw)/Rw]= 5.4955270
ln(Re/Rw)= 2.3494690

K (ft/day) = 23.7527200

T OF THE SATURATED SCREEN INTERVAL
(ft2/day)= 327.7876000

9313018.0519


WELL 299-E25-41, SLUG INJECTION TEST #4
WATER LEVEL CHANGE (ft)
1.00
0.80
0.60
0.40
0.20
0.00
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
TIME (min)


WELL 299-E25-41, SLUG INJECTION TEST #4
Yo PROJECTED = 0.89 ft
Yo OBSERVED = 0.94 ft
r_c= 0.2297 ft
LINEAR BEST FIT LINE; $\log_{10}(Y)$= -12.22x + -0.05
$K=(r_c^2 \ln(R_e/r_w)/2L_e t) * \ln(Y_o/Y_t)$
$K=((0.2297)^2 (2.35) / 2(13.8)(0.025)) * \ln(0.89/0.44)$
K= 182 ft/day
Y_t= 0.44 ft
t= 0.025 min
WATER LEVEL CHANGE (Y_t), (ft)
TIME (t), (min)
1
0.1
0.01
0.00
0.05
0.10
0.15
0.20
0.25
0.30

WELL 299-E25-41, SLUG INJECTION TEST #4

THE BELOW HYDRAULIC CONDUCTIVITY VALUE WAS CALCULATED
USING THE BOUWER AND RICE SLUG TEST METHOD.
SOURCE= "THE BOUWER AND RICE SLUG TEST-AN UPDATE"
GROUND WATER, VOL 27, NO. 3, MAY-JUNE 1989.

RADIUS OF CASING USED IN CALCULATIONS HAS BEEN
CORRECTED FOR THE THICKNESS OF GRAVEL OR SAND
PACK DUE TO WATER LEVEL CHANGES IN THE SCREEN OR
OPEN INTERVAL OF WELL.

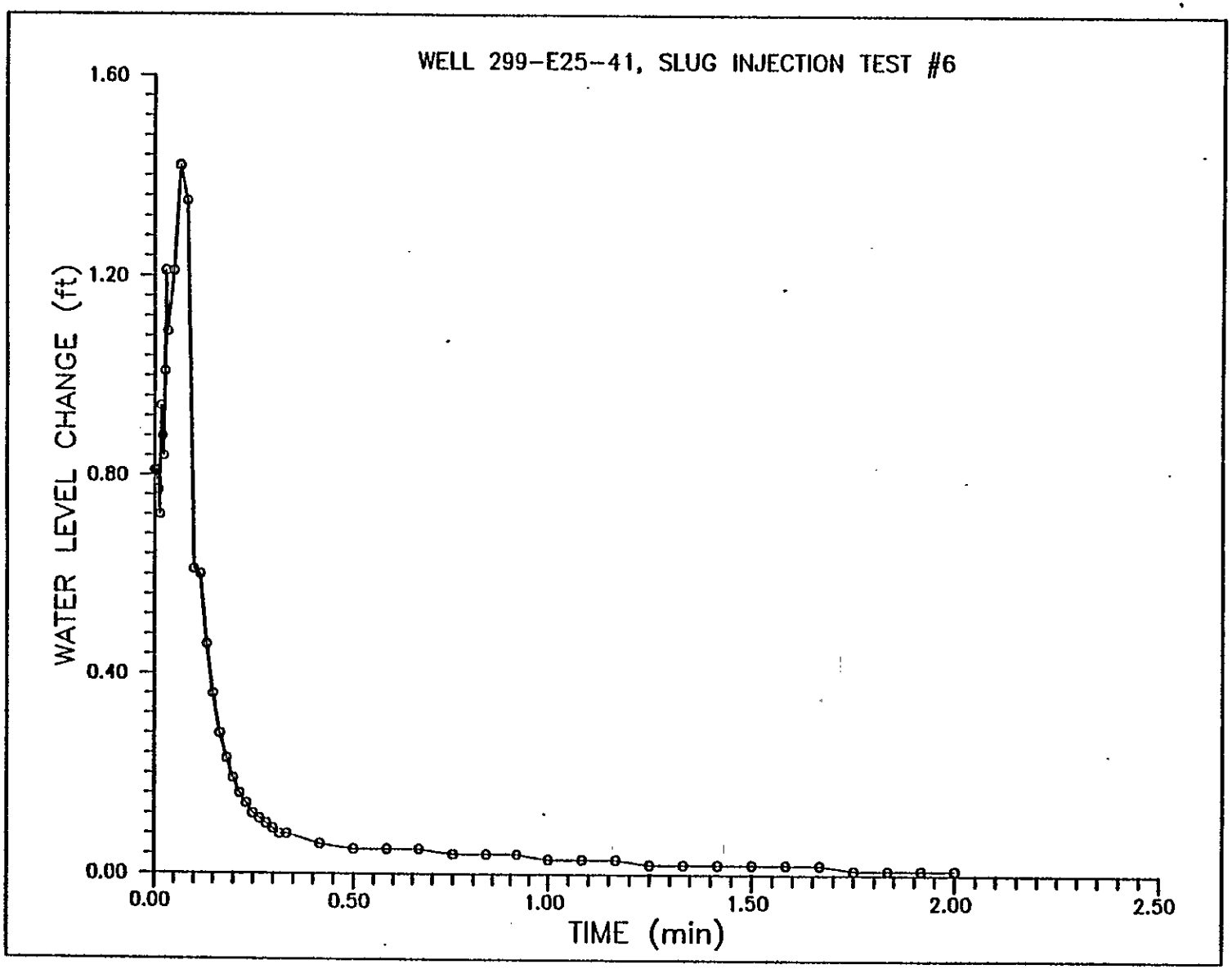
Rc (ft)	Rw (ft)	Le (ft)	Lw (ft)	H (ft)
.2297	.3333	13.8000	13.8000	95.0000

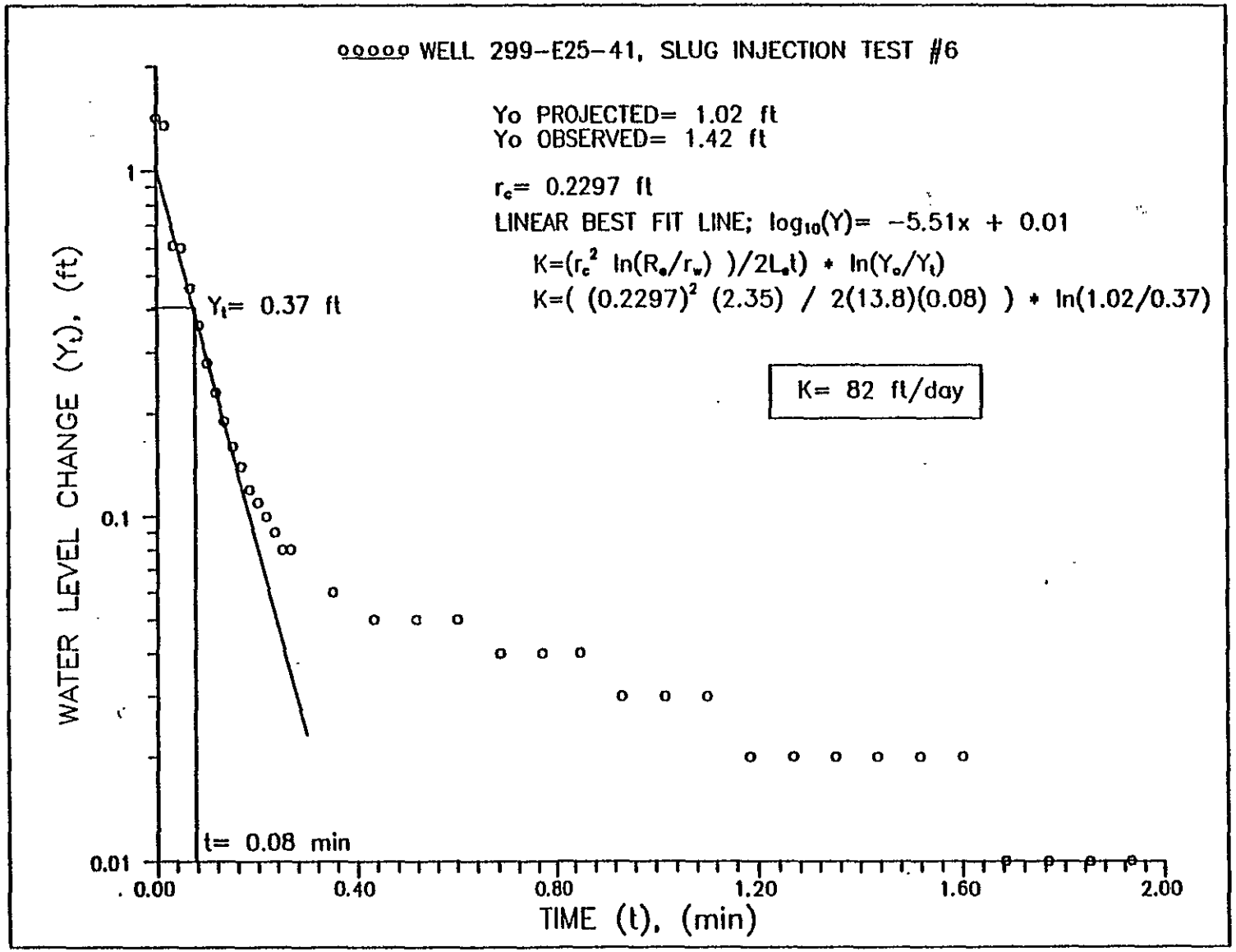
Le/Rw = 41.4000000
A= 2.8792960
B= 4.568365E-001
C= 2.4968560
SANDPACK POROSITY= 3.000000E-001
t (min)= 2.500000E-002
1/t= 40.0000000
Yo= (ft) 8.900000E-001
Yt= (ft) 4.400000E-001
1/t ln(Yo/Yt)= 28.1778700
ln[(H-Lw)/Rw]= 5.4955270
ln(Re/Rw)= 2.3494690

K (ft/day) = 182.2982000

T OF THE SATURATED SCREEN INTERVAL
(ft2/day)= 2515.7150000

9330.05


WELL 299-E25-41, SLUG INJECTION TEST #6
WATER LEVEL CHANGE (ft)
1.60
1.20
0.80
0.40
0.00
0.00
0.50
1.00
1.50
2.00
2.50
TIME (min)


WELL 299-E25-41, SLUG INJECTION TEST #6
Yo PROJECTED= 1.02 ft
Yo OBSERVED= 1.42 ft
r_c= 0.2297 ft
LINEAR BEST FIT LINE; $\log_{10}(Y)$= -5.51x + 0.01
$K=(r_c^2 \ln(R_e/r_w))/2L_e t) * \ln(Y_o/Y_t)$
$K=((0.2297)^2 (2.35) / 2(13.8)(0.08)) * \ln(1.02/0.37)$
K= 82 ft/day
Y_t= 0.37 ft
t= 0.08 min
WATER LEVEL CHANGE (Y_t), (ft)
1
0.1
0.01
0.00
0.40
0.80
1.20
1.60
2.00
TIME (t), (min)

WELL 299-E25-41, SLUG INJECTION TEST #6

THE BELOW HYDRAULIC CONDUCTIVITY VALUE WAS CALCULATED
USING THE BOUWER AND RICE SLUG TEST METHOD.
SOURCE= "THE BOUWER AND RICE SLUG TEST-AN UPDATE"
GROUND WATER, VOL 27, NO. 3, MAY-JUNE 1989.

RADIUS OF CASING USED IN CALCULATIONS HAS BEEN
CORRECTED FOR THE THICKNESS OF GRAVEL OR SAND
PACK DUE TO WATER LEVEL CHANGES IN THE SCREEN OR
OPEN INTERVAL OF WELL.

Rc (ft)	Rw (ft)	Le (ft)	Lw (ft)	H (ft)
.2297	.3333	13.8000	13.8000	95.0000

Le/Rw = 41.4000000
A= 2.8792960
B= 4.568365E-001
C= 2.4968560
SANDPACK POROSITY= 3.000000E-001
t (min)= 8.000000E-002
1/t= 12.5000000
Yo= (ft) 1.0200000
Yt= (ft) 3.700000E-001
1/t ln(Yo/Yt)= 12.6756900
ln[(H-Lw)/Rw]= 5.4955270
ln(Re/Rw)= 2.3494690

K (ft/day) = 82.0060400

T OF THE SATURATED SCREEN INTERVAL
(ft2/day)= 1131.6830000

9350125

APPENDIX D

TEST DATA AND ANALYSIS FOR WELL 299-E27-12

9313013.0526

APPENDIX D

TEST DATA AND ANALYSIS FOR WELL 299-E27-12

This appendix contains the as-built diagram for the well construction, Slug Test Record Form, Aquifer Test Data Sheets, Equipment Record Forms, Electronic Data Control Forms, and accompanying data logs and plots for well 299-E27-12.

9330.052

Battelle
Pacific Northwest Laboratories

AS-BUILT DIAGRAM

Well Number 299-E27-12 Geologist R Miller Page 1 of 5

Reviewed by W. McKown Date 12-7-89

Construction Data		Depth in Feet	Geologic/Hydrologic Data	
Description	Diagram		Diagram Litho.	Lithologic Description
temporary 10"ϕ carbon steel casing w/drive shoe from +1.0' to -127'2½"		5		Gravelly SAND
		10		"
		15		Gravelly SAND to mud.
		20		Gravelly SAND
temporary 8"ϕ carbon steel casing w/drive shoe from +3½" to 268'7"		25		"
		30		"
		35		Sand
		40		"
250.32' of 4" DIA.		45		"
STAINLESS STEEL CASING		50		"
		55		"
		60		"
		65		"
		70		
		75		Gravelly SAND
FACTORY WELDED CASING		80		"
CENTRALIZER		85		"
		90		"
		95		"
		100		"
		105		"
		110		"
		115		"
		120		SAND
		125		Gravelly SAND (cobbles)
		130		SAND (cemented)

9330.8-1572

PNL-MA-567, DO-1, Rev 0

A-1800-186 (3/87)

Battelle
Pacific Northwest Laboratories

AS-BUILT DIAGRAM

Well Number 299-E27-12 Geologist R.M.Lee Page 2 of 3

Reviewed by D.L. McGlan Date 12-7-89

Construction Data		Depth in Feet	Geologic/Hydrologic Data	
Description	Diagram		Diagram Litho.	Lithologic Description
temporary 8"ø carbon steel casing w/drive shoe from +3'6" to 268'7" (272'1")		135		SAND (sl. cemented)
		140		sl gravelly SAND
		145		"
		150		"
		155		"
		160		SANDY GRAVEL
		165		sl. gravelly SAND
250.32' of 4" DIA. STAINLESS STEEL CASING		170		SAND
		175		"
		180		"
		185		"
		190		"
		195		"
		200		"
		205		"
		210		"
		215		"
		220		"
		225		"
		230		Gravelly Sandy MUD @ 220-10" thick Muddy Sandy GRAVEL
		235		Sandy GRAVEL
		240		"
		245		"
21.03' of 4" DIA CHANNEL PACK SCREEN (10 SLOT)	252.1' 0/18	250		Muddy Sandy GRAVEL
		255		" (wet)
		260		Sandy GRAVEL

FNL-MA567, Ed-1, Rev 0

A-1800-186 (3/87)

9130018.1523

Battelle
Pacific Northwest Laboratories

AS-BUILT DIAGRAM

Well Number 299-E27-12 Geologist R. Miller Page 3 of 3

Reviewed by W. L. McGlaun Date 12-7-89

Construction Data		Depth in Feet	Geologic/Hydrologic Data	
Description	Diagram		Diagram Litho.	Lithologic Description
temporary 8" ϕ carbon steel from +3'6" to 268'7" (272'1")		265		Sandy GRAVEL
		270		"
				T.D. = 270.0'
21.03' of 4" DIA. STAINLESS STEEL CHANNEL PACK SCREEN				COMPLETION DEPTH = 267.55'
COMPLETION SYMBOLS:				
CEMENT GROUT				
GRANULAR BENTONITE				
BENTONITE PELLETS				
SILICA SAND				
CASING CENTRALIZER				
CASING JOINT				

9330.1527

Aquifer Test Data

WHC-SD-EN-TI-147, Rev. 0

page 1 of 1

Data for Well 299-E27-12
Pumping Well —
Observation Wells —

Location 200 East Area, C Tank Farm
Type of Aquifer Test Slug Test
How Q Measured —
How W.L.'s Measured E-tape 12174, trans
Rad./Dist. of/From Pumping Well 2"
Meas. Point for W.L.'s Top of 6" casing
Elevation of Meas. Point —
stand-up: 2.3 ft. to top of pad

Depth of Pump/Airpipe —
Pump On: date — time —
Pump Off: date — time —
Duration of Aquifer Test —

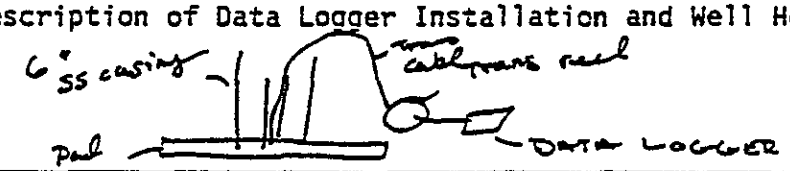
Time: t = ___ at t' = 0					Water Level Data: Static Water Level ___					Discharge		Recorded By	Comments
Day	Clock Time	t	t'	t/t'	Reading	Conversions or Corrections	Water Level	s or s'		Reading	Q		
												JUB	steel tape L300-14
													E-tape 12174
													DL: 1KB 701
													trans 259158
10/19	1357				255.95	E-tape							
					269.02	+ 2.47 =	271.49						bentonite in hole
	1420				14.98	trans							
	1421				14.98	ref. set							
	1425				start test 4	slug injection							
	1436				stopped test 4								
					14.99	trans	ref set						
	1439				start test 5	slug w/D							
	1449				.01	stopped test 5							
	1450				15.00	ref. set							
	1453				start test 6	slug inj							
	1503				0.00	stopped test 6							
	1506				start test 7	slug w/D							
	1516				0.0								
	1516:30				stopped test 7 and line rubbed against Trans.								
						may have damage trans. slightly during test 7							
10/20	0733				15.11'							DRN	trans.
	0738				Set slug below static water level								
	0739				15.14'	Set 0	ref set to 0.0						
	0743					Pull Slug							
	0753					Stop datalogger							
	0800				Withdraw a bail load to extract coarse material off bottom								
								Darrell [illegible] 10/20/89					

PNL-MA-567, AT-6, Rev. 0

Equipment Record Form for the Installation and Removal of Data Loggers and Pressure Transducers

Initial Check: JV LDR		
Purpose of Installation: monitored WL changes during slug test		
Monitored Hydrologic Unit or Water Body: sat. screened int.		
Date/Time of Installation: 10/19/89 1330	Procedure Followed: WL-4	
Data Logger Make/Model: Hermit SE1000B		
Serial No.: 1KB-701	Number of Channels Used: 1	
Pressure Transducer Make/Model: In Situ PTx 161D	Full Scale Range: 10 PSI	Well No.: 299-E27-12
	Serial No.: 259198	Depth: 14.9 below ground
Pressure Transducer Make/Model:	Full Scale Range:	Well No.:
	Serial No.:	Depth:

Description of Data Logger Installation and Well Head Configuration:



Comments:

Equipment Installed By	J.V. Borghese
Date/Time of Equipment Removal:	D. Logger removed 10/20 1500
Decontamination Procedure (if required):	
Equipment Removed By	JV Borghese

9913010.1926

Location C - TANK's Date of Test 10/19/89

Well Number 299-E27-12 Procedure Number AT-6

Type of Test(s) Slug

Personnel Conducting Test Borghese

WELL CONFIGURATION

Well Depth 271.5 TOC Borehole Diameter 8"

Well Casing Inside Diameter 4" Well Screen Inside Diameter 4"

Length of Screened Interval ~~10~~ 20' Depth of Screen 251-271

Comments Well is undeveloped

SLUG INFORMATION

Slug Construction Materials carbon steel

Length of Slug 6' Diameter of Slug 2.25"

Comments

Volume of Attachments (if applicable)

MEASUREMENT EQUIPMENT INFORMATION

	Make	Model	Serial Number
Electric Tape	see	aquifer	Not form
Steel Tape	and	equipment	used
Data logger	form.		
Transducer			
Other			

JUB 10/20/89

9330018.1522

(5/18/89, Rev. 0)

ELECTRONIC DATA CONTROL FORM

DATE AND START TIME OF DATA ACQUISITION 10/19/89 1425

DATE AND END TIME OF DATA ACQUISITION " 1436

WELL NUMBER 299-E27-12

TYPE OF TEST OR DATA slug injection

TYPE AND IDENTIFICATION NUMBER OF DATA LOGGER

Hermit SE1000B 1KB-701

TEST NUMBER X 4

CHANNEL OR INPUT NUMBER 1

UNITS OF VALUES RECORDED ft from ref. level

NUMBER OF PAGES ATTACHED 2

COMMENTS: Static DL late

DATA VALIDATION STATEMENT:

The attached data represent the data as originally recorded on the data logger. Any exceptions and reasons for such are indicated in the comments section.

J V Bailey Scientist 10/20/89

Name, title Date

8913010.1528

Well: 299-E27-12
Test Date: October 19, 1989
Start time: 14:25

SE1000B
Environmental Logger
10/19 16:52

Unit# 00701 Test# 4

INPUT 1: Level (F)

Reference	0.00
Scale factor	9.99
Offset	- 0.01

Elapsed Time, min	Value, ft
0.0000	0.30
0.0033	- 0.50
0.0066	- 0.14
0.0099	0.18
0.0133	- 0.13
0.0166	0.05
0.0200	0.00
0.0233	0.02
0.0266	0.02
0.0300	0.02
0.0333	0.03
0.0500	- 0.00
0.0666	0.00
0.0833	0.00
0.1000	0.00
0.1166	0.00
0.1333	0.00
0.1500	0.00
0.1666	0.00
0.1833	0.00
0.2000	0.00
0.2166	0.00
0.2333	0.00
0.2500	0.00
0.2666	0.00
0.2833	0.00
0.3000	0.00
0.3166	0.00
0.3333	0.00
0.4167	0.00
0.5000	0.00
0.5833	0.00
0.6667	0.00
0.7500	0.00
0.8333	0.00
0.9167	0.00
1.0000	0.00
1.0833	0.00
1.1667	0.00
1.2500	0.00
1.3333	0.00
1.4166	0.00
1.5000	0.00
1.5833	0.00
1.6667	0.00
1.7500	0.00
1.8333	0.00
1.9167	0.00
2.0000	0.00
2.5000	0.00
3.0000	0.00
3.5000	0.00
4.0000	0.00
4.5000	0.00
5.0000	0.00
5.5000	0.00
6.0000	0.00
6.5000	0.00
7.0000	0.00
7.5000	0.00
8.0000	0.00
8.5000	0.00
9.0000	0.00
9.5000	0.00
10.0000	0.00

END

9330043.1570

(5/18/89, Rev. 0)

ELECTRONIC DATA CONTROL FORM

DATE AND START TIME OF DATA ACQUISITION 10/19/89 1439

DATE AND END TIME OF DATA ACQUISITION " 1449

WELL NUMBER 299-E27-12

TYPE OF TEST OR DATA Slug WD

TYPE AND IDENTIFICATION NUMBER OF DATA LOGGER

Hermit SE1000B 1KB-701

TEST NUMBER 5

CHANNEL OR INPUT NUMBER 1

UNITS OF VALUES RECORDED ft from ref. level

NUMBER OF PAGES ATTACHED 2

COMMENTS:

started DL late

DATA VALIDATION STATEMENT:

The attached data represent the data as originally recorded on the data logger. Any exceptions and reasons for such are indicated in the comments section.

J V Bergstrom Scientist — 10/20/89

Name, title — Date

9330.0 (5/89)

Well: 299-E27-12
Test Date: October 19, 1989
Start Time: 14:39

SE1000B
Environmental Logger
10/19 16:53

Unit# 00701 Test# 5

INPUT 1: Level (F)

Reference	0.00
Scale factor	9.99
Offset	- 0.01

Elapsed Time, min	Value, ft
0.0000	- 0.15
0.0033	- 0.31
0.0066	- 0.34
0.0099	- 0.32
0.0133	- 0.26
0.0166	- 0.17
0.0200	- 0.09
0.0233	- 0.02
0.0266	0.01
0.0300	0.03
0.0333	0.03
0.0500	0.00
0.0666	- 0.00
0.0833	- 0.00
0.1000	- 0.00
0.1166	- 0.00
0.1333	- 0.00
0.1500	- 0.00
0.1666	- 0.00
0.1833	- 0.00
0.2000	- 0.00
0.2166	- 0.00
0.2333	- 0.00
0.2500	- 0.00
0.2666	- 0.00
0.2833	- 0.00
0.3000	- 0.00
0.3166	- 0.00
0.3333	- 0.00
0.4167	- 0.00
0.5000	- 0.00
0.5833	- 0.00
0.6667	- 0.00
0.7500	- 0.00
0.8333	- 0.00
0.9167	- 0.00
1.0000	- 0.00
1.0833	- 0.00
1.1667	- 0.00
1.2500	- 0.00
1.3333	- 0.00
1.4166	- 0.00
1.5000	- 0.00
1.5833	- 0.00
1.6667	- 0.00
1.7500	- 0.00
1.8333	- 0.00
1.9167	- 0.00
2.0000	- 0.00
2.5000	- 0.00
3.0000	- 0.00
3.5000	- 0.00
4.0000	- 0.00
4.5000	- 0.00
5.0000	- 0.00
5.5000	- 0.00
6.0000	- 0.00
6.5000	- 0.00
7.0000	- 0.00
7.5000	- 0.00
8.0000	- 0.00
8.5000	- 0.00
9.0000	- 0.00
9.5000	- 0.00
10.0000	- 0.00

END

93 30 09 153

(5/18/89, Rev. 0)

ELECTRONIC DATA CONTROL FORM

DATE AND START TIME OF DATA ACQUISITION 10/19/89 1453

DATE AND END TIME OF DATA ACQUISITION " 1503

WELL NUMBER 299-E27-12

TYPE OF TEST OR DATA Slug injection

TYPE AND IDENTIFICATION NUMBER OF DATA LOGGER

Uranit SE1000B IKB-701

TEST NUMBER 6

CHANNEL OR INPUT NUMBER 1

UNITS OF VALUES RECORDED ft from ref. level

NUMBER OF PAGES ATTACHED 2

COMMENTS:

DATA VALIDATION STATEMENT:

The attached data represent the data as originally recorded on the data logger. Any exceptions and reasons for such are indicated in the comments section.

J.V. Borghese Scientist 10/20/89

Name, title Date

9130010.1532

Well: 299-E27-12
Test Date: October 19, 1989
Start Time: 14:53

SE1000B
Environmental Logger
10/19 16:55

Unit# 00701 Test# 6

INPUT 1: Level (F)

Reference	0.00
Scale factor	9.99
Offset	- 0.01

Elapsed Time, min	Value, ft
0.0000	0.55
0.0033	0.57
0.0066	0.56
0.0099	0.51
0.0133	0.51
0.0166	0.52
0.0200	0.21
0.0233	- 0.35
0.0266	- 0.54
0.0300	0.06
0.0333	- 0.23
0.0500	0.03
0.0666	0.01
0.0833	0.00
0.1000	0.00
0.1166	0.00
0.1333	0.00
0.1500	0.00
0.1666	0.00
0.1833	0.00
0.2000	0.00
0.2166	0.00
0.2333	0.00
0.2500	0.00
0.2666	0.00
0.2833	0.00
0.3000	0.00
0.3166	0.00
0.3333	0.00
0.4167	0.00
0.5000	0.00
0.5833	0.00
0.6667	0.00
0.7500	0.00
0.8333	0.00
0.9167	0.00
1.0000	0.00
1.0833	0.00
1.1667	0.00
1.2500	0.00
1.3333	0.00
1.4166	0.00
1.5000	0.00
1.5833	0.00
1.6667	0.00
1.7500	0.00
1.8333	0.00
1.9167	0.00
2.0000	0.00
2.5000	0.00
3.0000	0.00
3.5000	0.00
4.0000	0.00
4.5000	0.00
5.0000	0.00
5.5000	0.00
6.0000	0.00
6.5000	0.00
7.0000	0.00
7.5000	0.00
8.0000	0.00
8.5000	0.00
9.0000	0.00
9.5000	0.00
10.0000	0.00

END

9130010.1553

(5/18/89, Rev. 0)

ELECTRONIC DATA CONTROL FORM

DATE AND START TIME OF DATA ACQUISITION 10/19/89 1506

DATE AND END TIME OF DATA ACQUISITION 10/19/89 1516

WELL NUMBER 299-E27-12

TYPE OF TEST OR DATA Slug W/D

TYPE AND IDENTIFICATION NUMBER OF DATA LOGGER

Hermit SE1000B IKR-701

TEST NUMBER 7

CHANNEL OR INPUT NUMBER 1

UNITS OF VALUES RECORDED ft from ref. level

NUMBER OF PAGES ATTACHED 2

COMMENTS:

Started D Logger late

DATA VALIDATION STATEMENT:

The attached data represent the data as originally recorded on the data logger. Any exceptions and reasons for such are indicated in the comments section.

Jane V Borghese Scientist — Name, title

10/20/89 — Date

9330018.1594

Well: 299-E27-12
Test Date: October 19, 1989
Start Time: 15:06

SE1000B
Environmental Logger
10/19 16:57

Unit# 00701 Test# 7

INPUT 1: Level (F)

Reference	0.00
Scale factor	9.99
Offset	- 0.01

Elapsed Time, min	Value, ft
0.0000	- 0.24
0.0033	- 0.31
0.0066	- 0.28
0.0099	- 0.20
0.0133	- 0.13
0.0166	- 0.06
0.0200	0.00
0.0233	0.03
0.0266	0.05
0.0300	0.06
0.0333	0.03
0.0500	0.00
0.0666	0.00
0.0833	0.01
0.1000	0.00
0.1166	0.00
0.1333	0.00
0.1500	0.00
0.1666	0.00
0.1833	0.00
0.2000	0.00
0.2166	0.00
0.2333	0.00
0.2500	0.00
0.2666	0.00
0.2833	0.00
0.3000	0.00
0.3166	0.00
0.3333	0.00
0.4167	0.00
0.5000	0.00
0.5833	0.00
0.6667	0.00
0.7500	0.00
0.8333	0.00
0.9167	0.00
1.0000	0.00
1.0833	0.00
1.1667	0.00
1.2500	0.00
1.3333	0.00
1.4166	0.00
1.5000	0.00
1.5833	0.00
1.6667	0.00
1.7500	0.00
1.8333	0.00
1.9167	0.00
2.0000	0.00
2.5000	0.00
3.0000	0.00
3.5000	0.00
4.0000	0.00
4.5000	0.00
5.0000	0.00
5.5000	0.00
6.0000	0.00
6.5000	0.00
7.0000	0.00
7.5000	0.00
8.0000	0.00
8.5000	0.00
9.0000	0.00
9.5000	0.00
10.0000	0.00

END

9350.1527

(5/18/89, Rev. 0)

ELECTRONIC DATA CONTROL FORM

DATE AND START TIME OF DATA ACQUISITION 10/20/89 0743 hrs

DATE AND END TIME OF DATA ACQUISITION 10/20/89 0753 hrs

WELL NUMBER 299-E27-12

TYPE OF TEST OR DATA Slug wd

TYPE AND IDENTIFICATION NUMBER OF DATA LOGGER In Situ Hermit SE1000B, S/N 1KB-701

TEST NUMBER 0

CHANNEL OR INPUT NUMBER 1

UNITS OF VALUES RECORDED ft

NUMBER OF PAGES ATTACHED 2

COMMENTS: Test 0 = Withdraw Slug

DATA VALIDATION STATEMENT:

The attached data represent the data as originally recorded on the data logger. Any exceptions and reasons for such are indicated in the comments section.

Darrell Newcomer, Scientist — Name, title

10/20/89 — Date

9330018.0536

Well: 299-E27-12
Test Date: October 20, 1989
Start Time: 07:43

SE1000B
Environmental Logger
10/20 15:54

Unit# 00701 Test# 0

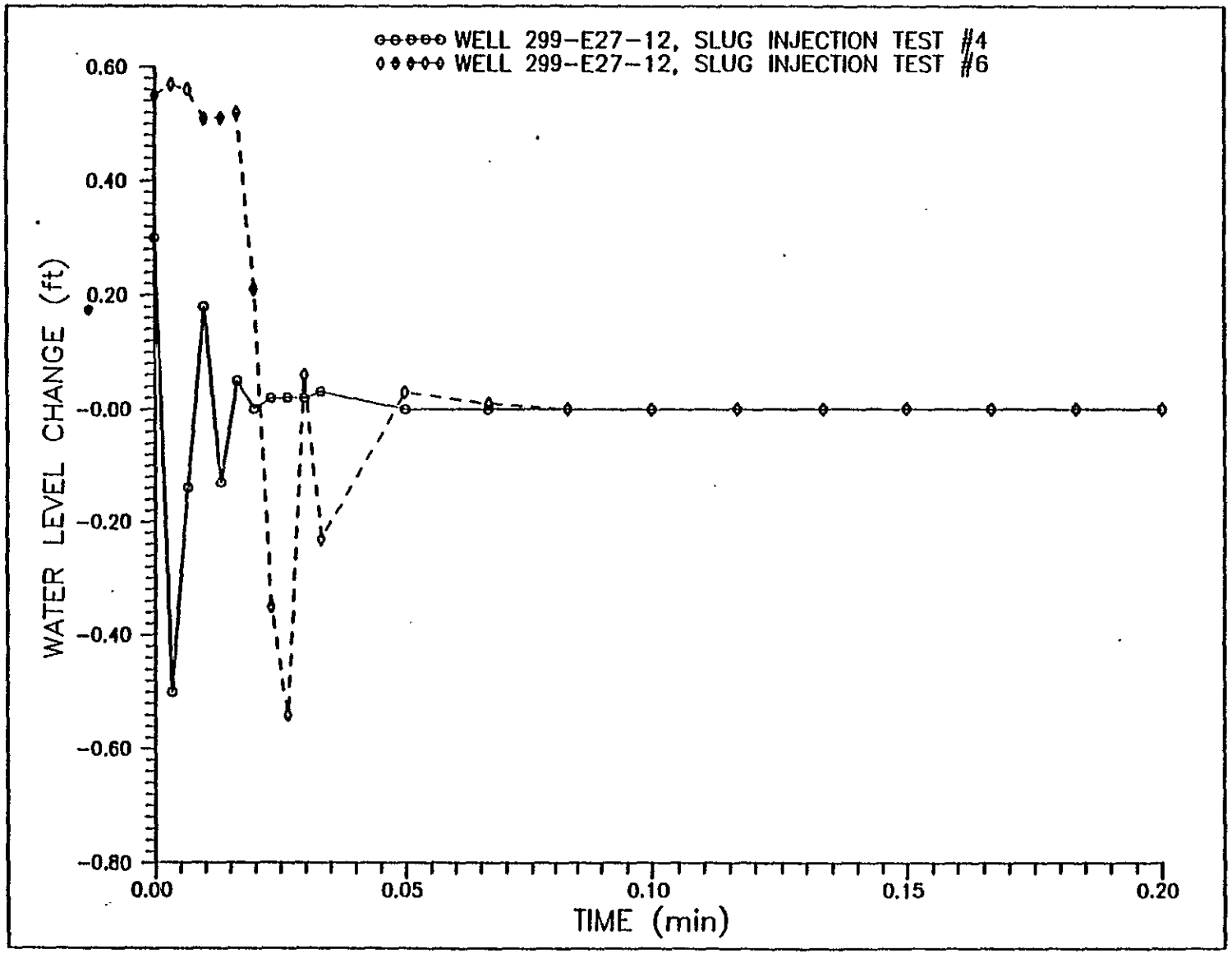
INPUT 1: Level (F)

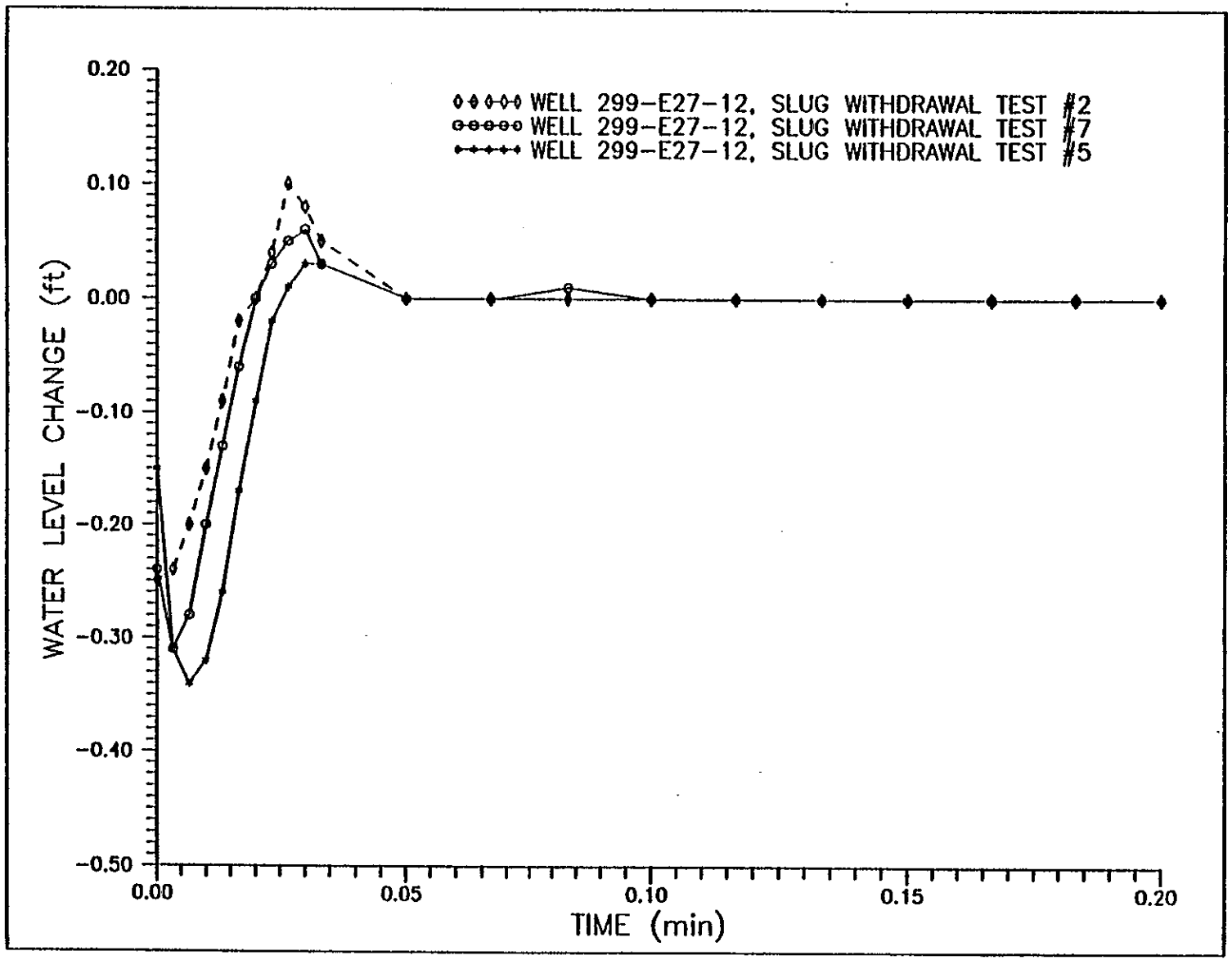
Reference	0.00
Scale factor	9.99
Offset	- 0.01

Elapsed Time, min	Value, ft
0.0000	- 0.25
0.0033	- 0.24
0.0066	- 0.20
0.0099	- 0.15
0.0133	- 0.09
0.0166	- 0.02
0.0200	0.00
0.0233	0.04
0.0266	0.10
0.0300	0.08
0.0333	0.05
0.0500	0.00
0.0666	- 0.00
0.0833	0.00
0.1000	0.00
0.1166	0.00
0.1333	0.00
0.1500	- 0.00
0.1666	- 0.00
0.1833	- 0.00
0.2000	- 0.00
0.2166	- 0.00
0.2333	- 0.00
0.2500	- 0.00
0.2666	- 0.00
0.2833	- 0.00
0.3000	- 0.00
0.3166	- 0.00
0.3333	- 0.00
0.4167	- 0.00
0.5000	- 0.00
0.5833	- 0.00
0.6667	- 0.00
0.7500	- 0.00
0.8333	- 0.00
0.9167	- 0.00
1.0000	- 0.00
1.0833	- 0.00
1.1667	- 0.00
1.2500	- 0.00
1.3333	- 0.00
1.4166	- 0.00
1.5000	- 0.00
1.5833	- 0.00
1.6667	- 0.00
1.7500	- 0.00
1.8333	- 0.00
1.9167	- 0.00
2.0000	- 0.00
2.5000	- 0.00
3.0000	- 0.00
3.5000	- 0.00
4.0000	- 0.00
4.5000	- 0.00
5.0000	- 0.00
5.5000	- 0.00
6.0000	- 0.01
6.5000	- 0.01
7.0000	- 0.01
7.5000	- 0.01
8.0000	- 0.01
8.5000	- 0.01
9.0000	- 0.01
9.5000	- 0.01
10.0000	- 0.01

END

9320.1532


WELL 299-E27-12, SLUG INJECTION TEST #4
WELL 299-E27-12, SLUG INJECTION TEST #6
WATER LEVEL CHANGE (ft)
0.60
0.40
0.20
-0.00
-0.20
-0.40
-0.60
-0.80
0.00
0.05
0.10
0.15
0.20
TIME (min)


WELL 299-E27-12, SLUG WITHDRAWAL TEST #2
WELL 299-E27-12, SLUG WITHDRAWAL TEST #7
WELL 299-E27-12, SLUG WITHDRAWAL TEST #5
WATER LEVEL CHANGE (ft)
0.20
0.10
0.00
-0.10
-0.20
-0.30
-0.40
-0.50
0.00
0.05
0.10
0.15
0.20
TIME (min)

APPENDIX E

TEST DATA AND ANALYSIS FOR WELL 299-E27-13

ENGINEERING DATA

APPENDIX E

TEST DATA AND ANALYSIS FOR WELL 299-E27-13

This appendix contains the as-built diagram for the well construction, Slug Test Record Form, Aquifer Test Data Sheets, Equipment Record Forms, Electronic Data Control Forms, and accompanying data logs and plots for well 299-E27-13.

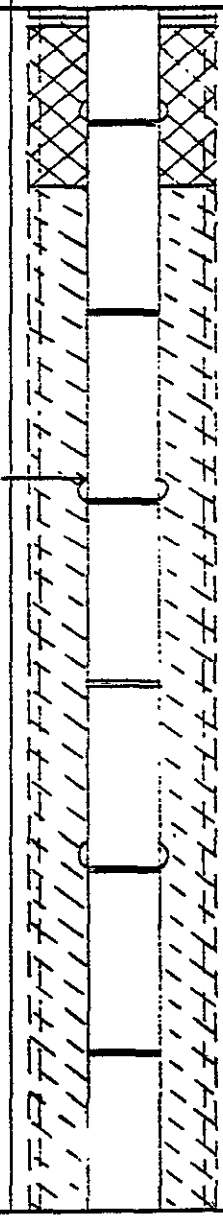
9351 0085136

Battelle
Pacific Northwest Laboratories

AS-BUILT DIAGRAM

Well Number 299-E27-13 Geologist Ian Kennedy Page 1 of 3

Reviewed by J.T. McGhan Date 12-6-89

Construction Data		Depth in Feet	Geologic/Hydrologic Data	
Description	Diagram		Diagram Litho.	Lithologic Description
10" diameter temporary carbon steel casing with drive shoe from 0' to 138'-6½"		5		Sandy Gravel
8" diameter temporary carbon steel casing with drive shoe from 1'-6½" to 273'-1½"		10		"
		15		Slightly gravelly sand
		20		gravelly sand
		25		"
		30		sandy gravel
		35		"
		40		Sand
		45		"
		50		"
255.43' of 4" DIA. STAINLESS STEEL CASING		55		"
		60		"
		65		Slightly gravelly sand
		70		" " "
		75		" " "
		80		Sand
		85		Slightly gravelly sand
		90		" " "
		95		" " "
		100		gravelly sand
		105		" "
		110		"
		115		Slightly gravelly sand
		120		Sand
		125		"
		130		

A-1800-186 (3/87)

PNL MA SEF DO-1, rev 0

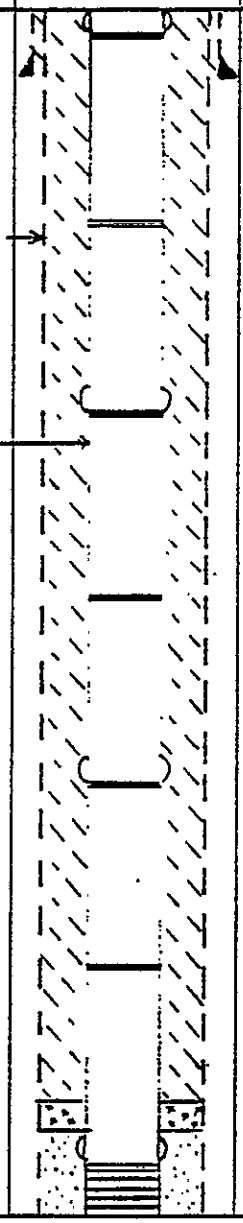
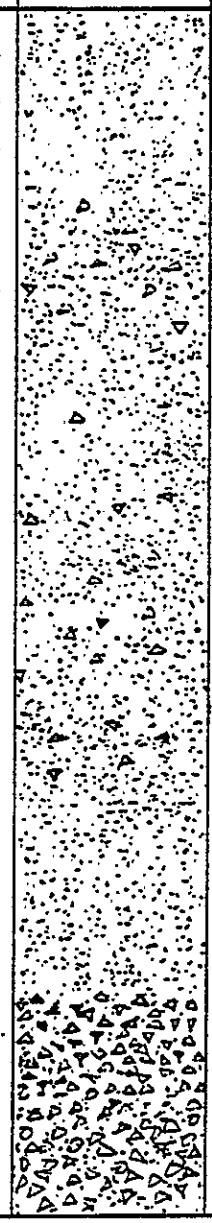
9352044597

Battelle
Pacific Northwest Laboratories

AS-BUILT DIAGRAM

Well Number 299-E27-13 Geologist Ian Kennedy Page 2 of 3

Reviewed by D.L. Marshall Date 12-6-89

Construction Data		Depth in Feet	Geologic/Hydrologic Data	
Description	Diagram		Diagram Litho.	Lithologic Description
139' 6 1/8" of 10" CARBON STEEL CASING		135'		Sand
		140'		"
		145'		"
		150'		"
278' 8 1/8" of 8" CARBON STEEL CASING		155'		Slightly gravelly sand
		160'		Gravelly Sand
		165'		Slightly gravelly sand
		170'		Sand
295.48' of 4" STAINLESS STEEL CASING		175'		"
		180'		
		185'		Slightly gravelly Sand
		190'		Slightly Gravelly sand
		195'		" " "
		200'		" " "
		205'		Sand
		210'		Slightly gravelly sand
		215'		Gravelly Sand
		220'		" "
		225'		Sand
		230'		Sand
		235'		Sand
		240'		Sand, Gravel
		245'		" "
		250'		" "
		255'		" "
		260'		" "

PNL MA567 DQ1, Rev.0

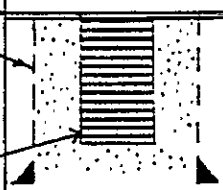
A-1800-186 (3/87)

Battelle
Pacific Northwest Laboratories

AS-BUILT DIAGRAM

Well Number 299-E27-13 Geologist Ian Kennedy Page 3 of 3

Reviewed by V.E. McGhan Date 12-6-89

Construction Data		Depth in Feet	Geologic/Hydrologic Data	
Description	Diagram		Diagram Litho.	Lithologic Description D/W = 260.73' 10/12/89
278'6½" OF 5" CARBON STEEL CASING		265		Sandy Gravel
		270		Gravel
		275		GRAVEL-
21' of 4" DIA. STAINLESS STEEL CHANNEL PACK SCREEN (10 SLOT)				D/R = 275.56 10/9/89
COMPLETION SYMBOLS: CEMENT GROUT GRANULAR BENTONITE BENTONITE PELLETS SILICA SAND CASING JOINT CASING CENTRALIZER				

PNL MAS67 00-1, rev. 0

A-1800-188 (3/8"

9230.1(GT)

Aquifer Test Data

WHC-SD-EN-TI-147, Rev. 0

page 1 of 1

Data for Well 299-E27-13

Location 200 East C Tank Farm

Type of Aquifer Test Slug Test

Pumping Well —

Observation Wells —

How Q Measured —

How W.L.'s Measured E tape (s/n 12174), transducer

Depth of Pump/Airpipe —

(Rad)/Dist (of) From Pumping Well 2"

Pump On: date — time

Meas. Point for W.L.'s Top of 4" casing

Pump Off: date — time

Elevation of Meas. Point

Duration of Aquifer Test —

Top of 4" I.D. casing is 1.8 ft. above ground surface

Time t = ____ at t' = 0					Water Level Data Static Water Level ____					Discharge		Recorded By	Comments
Day	Clock Time	t	t'	t/t'	Reading	Conversions or Corrections	Water Level	s or s'		Reading	Q		
10/20	0820											DRN	Set up rig
	0826				262.34'								E-tape
	0832				D/B = 273.70 + 2.47 = 276.17'								Steel tape #L300-14
	0840				Set slug below static water								
	0844				13.86'	set ref = 0		Test #1					Trans.
	0946					Pull slug							
	0856					Stop datalogger							
					Set slug below static water								
	0857				13.88'	ref = 0		Test #2					Trans.
	0900					Pull slug							
	0910					Stop test							
↓	0925				Withdraw a bail load							↓	

Darrell Newcomer 10/20/89

9310130163

Location 200 East, C Tank Farm Date of Test 10/20/89

Well Number 299-E27-13 Procedure Number PNL-MA-567 AT-6, Rev 0

Type of Test(s) Slug Withdrawal Test

Personnel Conducting Test D. R. Newcomer

WELL CONFIGURATION

Well Depth 274.37' below land surface Borehole Diameter 8"

Well Casing Inside Diameter 4" Well Screen Inside Diameter 4"

Length of Screened Interval 13.91' (below water) Depth of Screen 274.68'-253.68' bls.

Comments Well is undeveloped

SLUG INFORMATION

Slug Construction Materials Carbon steel

Length of Slug 6.0' Diameter of Slug 2 1/4"

Comments

Volume of Attachments (if applicable)

MEASUREMENT EQUIPMENT INFORMATION

	Make	Model	Serial Number
Electric Tape	Slope Indicator	51453	12174
Steel Tape	Lufkin	Super-Hiway Nubian	L300-14
Data logger	In Situ	Hermit SE 1000 B	1KB-701
Transducer	Druck	PTX-161D	259198
Other			

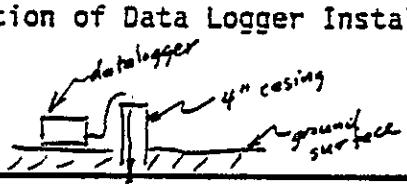
Darrell Newcomer 10/20/89

9330015.0515

Equipment Record Form for the Installation and Removal of Data Loggers and Pressure Transducers

Initial Check: ok		
Purpose of Installation: To monitor slug withdrawal test response		
Monitored Hydrologic Unit or Water Body: Uppermost Unconfined Aquifer		
Date/Time of Installation: 10/20/89 0840 hrs.	Procedure Followed: PNL-MA-567 WL-4, Rev 0	
Data Logger Make/Model: In Situ / SE1000 B		
Serial No.: 1KB-701	Number of Channels Used: 1	
Pressure Transducer Make/Model: Druck / PTX-161D	Full Scale Range: 10 psi	Well No.: 299-E27-13
	Serial No.: 259198	Depth: ~274.4' below LS.
Pressure Transducer Make/Model:	Full Scale Range:	Well No.:
	Serial No.:	Depth:

Description of Data Logger Installation and Well Head Configuration:



Stickup of 4" casing is 1.8' above land surface.

Comments: Slug was positioned above the water before placing transducer down to the bottom of the well. Slug was then lowered into position below water. Cement pad has not been poured yet.

Equipment Installed By D. R. Newcomer	
Date/Time of Equipment Removal: 10/20/89 0915 hrs.	
Decontamination Procedure (if required):	
Equipment Removed By D. R. Newcomer	

(5/18/89, Rev. 0)

ELECTRONIC DATA CONTROL FORM

DATE AND START TIME OF DATA ACQUISITION 10/20/89 0846 hrs.

DATE AND END TIME OF DATA ACQUISITION 10/20/89 0856 hrs.

WELL NUMBER 299 - E27-13

TYPE OF TEST OR DATA Slug Test

TYPE AND IDENTIFICATION NUMBER OF DATA LOGGER In Situ Hermit SE1000 B S/N 1KB-701

TEST NUMBER 1

CHANNEL OR INPUT NUMBER 1

UNITS OF VALUES RECORDED ft

NUMBER OF PAGES ATTACHED 2

COMMENTS: Test 1 = Withdraw Slug

DATA VALIDATION STATEMENT:

The attached data represent the data as originally recorded on the data logger. Any exceptions and reasons for such are indicated in the comments section.

Darrell Newcomer, Scientist — Name, title

10/20/89 — Date

9310010548

Well: 299-E27-13
Test Date: October 20, 1989
Start Time: 08:46

SE1000B
Environmental Logger
10/20 15:57

Unit# 00701 Test# 1

INPUT 1: Level (F)

Reference	0.00
Scale factor	9.99
Offset	- 0.01

Elapsed Time, min	Value, ft
0.0000	- 0.23
0.0033	- 0.10
0.0066	- 0.53
0.0099	- 0.46
0.0133	- 0.36
0.0166	- 0.30
0.0200	- 0.24
0.0233	- 0.20
0.0266	- 0.17
0.0300	- 0.15
0.0333	- 0.14
0.0500	- 0.06
0.0666	- 0.01
0.0833	- 0.00
0.1000	0.00
0.1166	0.00
0.1333	0.00
0.1500	0.00
0.1666	0.00
0.1833	0.00
0.2000	0.00
0.2166	0.00
0.2333	0.00
0.2500	0.00
0.2666	0.00
0.2833	0.00
0.3000	0.00
0.3166	0.00
0.3333	0.00
0.4167	0.00
0.5000	0.00
0.5833	0.00
0.6667	0.00
0.7500	0.00
0.8333	0.00
0.9167	0.00
1.0000	0.00
1.0833	0.00
1.1667	0.00
1.2500	0.00
1.3333	0.00
1.4166	0.00
1.5000	0.00
1.5833	0.00
1.6667	0.00
1.7500	0.00
1.8333	0.00
1.9167	0.00
2.0000	0.00
2.5000	0.01
3.0000	0.01
3.5000	0.00
4.0000	0.01
4.5000	0.01
5.0000	0.01
5.5000	0.01
6.0000	0.01
6.5000	0.01
7.0000	0.01
7.5000	0.01
8.0000	0.01
8.5000	0.01
9.0000	0.01
9.5000	0.01
10.0000	0.01

END

9130110.0510

(5/18/89, Rev. 0)

ELECTRONIC DATA CONTROL FORM

DATE AND START TIME OF DATA ACQUISITION 10/20/89 9:00

DATE AND END TIME OF DATA ACQUISITION 10/20/89 0910 hrs.

WELL NUMBER 299-E27-13

TYPE OF TEST OR DATA Slug Test

TYPE AND IDENTIFICATION NUMBER OF DATA LOGGER In Situ Hermit SE1000 B, S/N 1KB-701

TEST NUMBER 2

CHANNEL OR INPUT NUMBER 1

UNITS OF VALUES RECORDED ft

NUMBER OF PAGES ATTACHED 2

COMMENTS: Test 2 = Withdraw Slug

DATA VALIDATION STATEMENT:

The attached data represent the data as originally recorded on the data logger. Any exceptions and reasons for such are indicated in the comments section.

Darrell Newcomer, Scientist — Name, title

10/20/89 — Date

9330018.1550

Well: 299-E27-13
Test Date: October 20, 1989
Start Time: 09:00

SE1000B
Environmental Logger
10/20 15:59

Unit# 00701 Test# 2

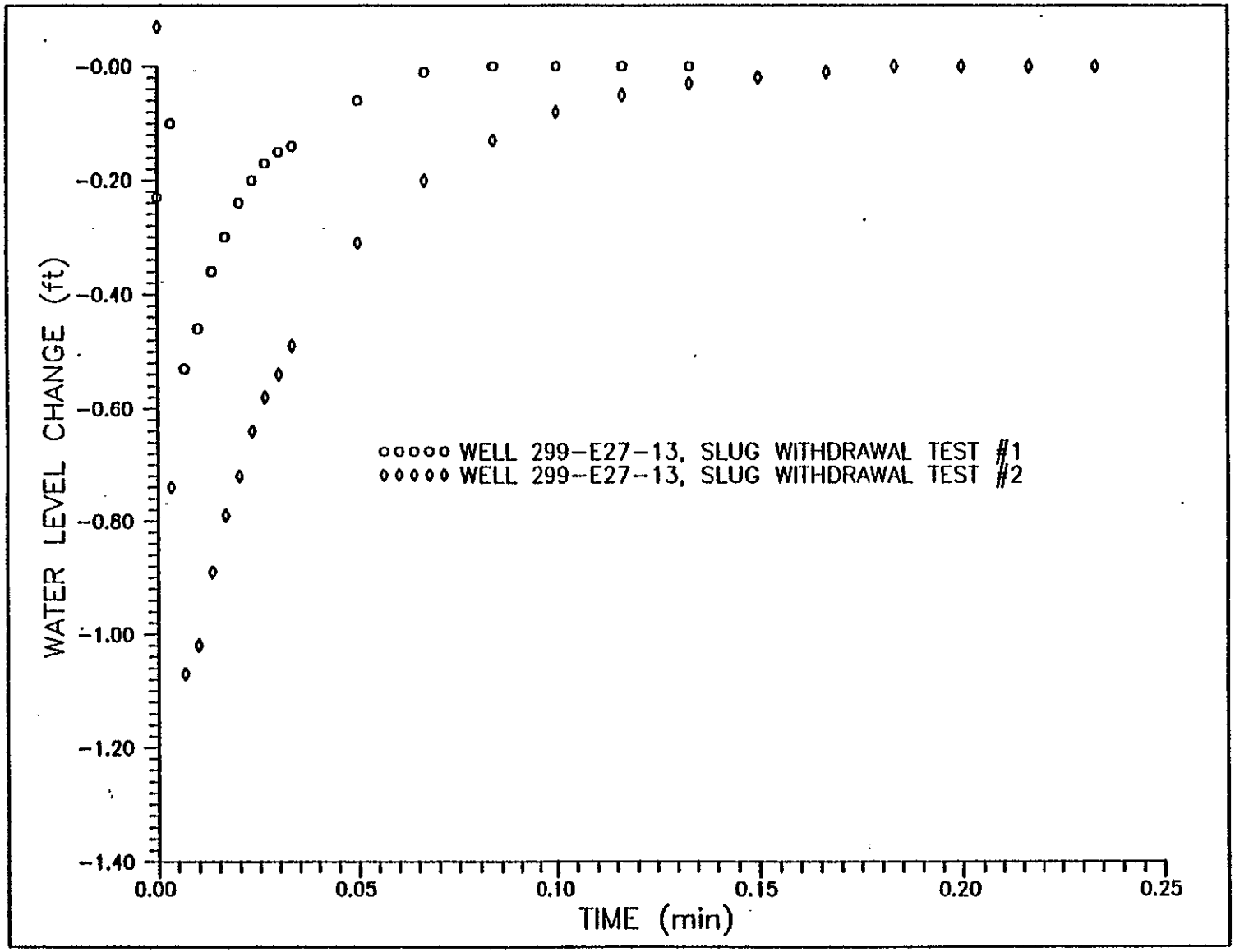
INPUT 1: Level (F)

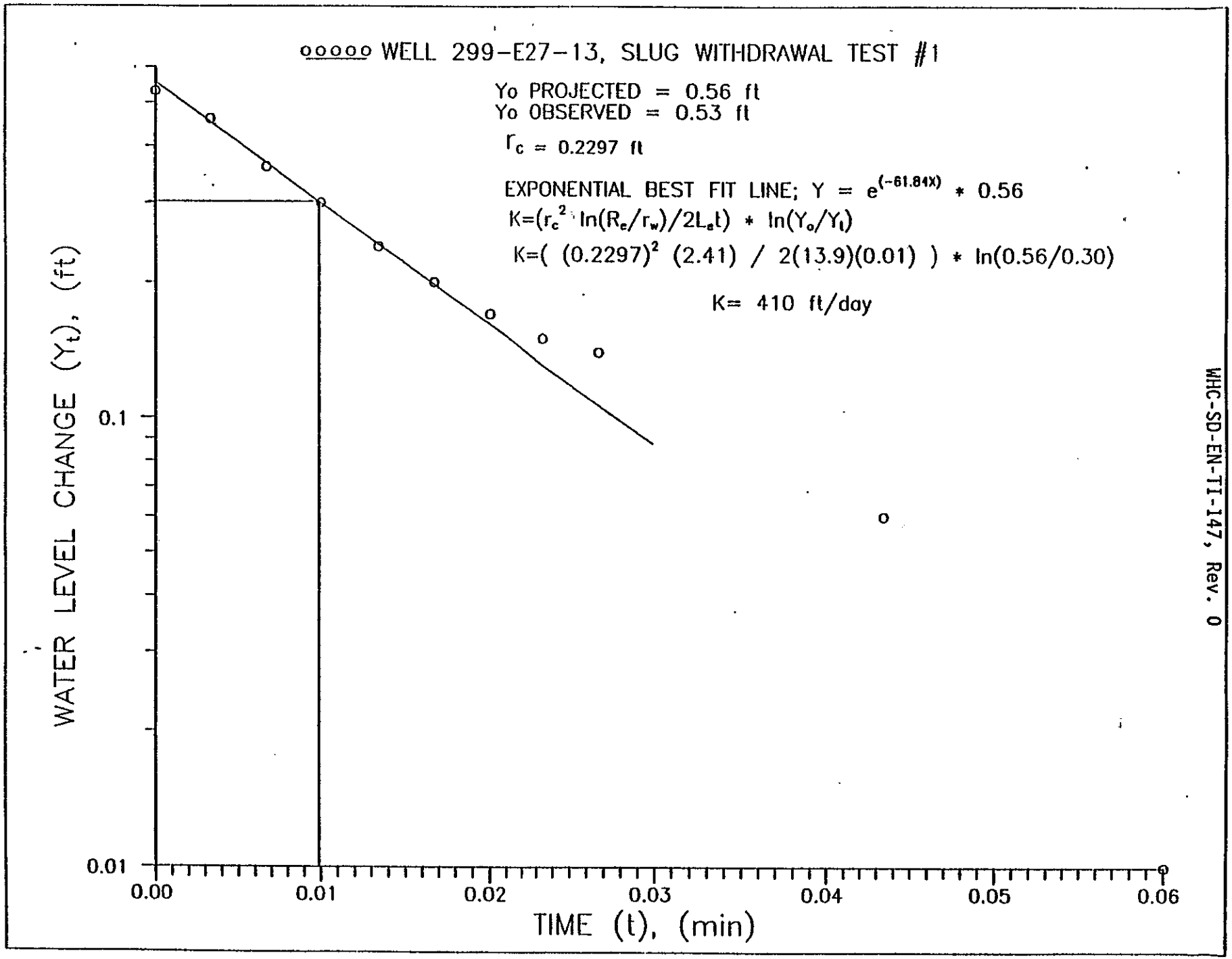
Reference	0.00
Scale factor	9.99
Offset	- 0.01

Elapsed Time, min	Value, ft
0.0000	0.07
0.0033	- 0.74
0.0066	- 1.07
0.0099	- 1.02
0.0133	- 0.89
0.0166	- 0.79
0.0200	- 0.72
0.0233	- 0.64
0.0266	- 0.58
0.0300	- 0.54
0.0333	- 0.49
0.0500	- 0.31
0.0666	- 0.20
0.0833	- 0.13
0.1000	- 0.08
0.1166	- 0.05
0.1333	- 0.03
0.1500	- 0.02
0.1666	- 0.01
0.1833	- 0.00
0.2000	- 0.00
0.2166	- 0.00
0.2333	0.00
0.2500	0.00
0.2666	0.00
0.2833	0.00
0.3000	0.00
0.3166	0.00
0.3333	0.00
0.4167	0.00
0.5000	0.00
0.5833	0.00
0.6667	0.00
0.7500	0.00
0.8333	0.00
0.9167	0.00
1.0000	0.00
1.0833	0.00
1.1667	0.00
1.2500	0.00
1.3333	0.00
1.4166	0.00
1.5000	0.00
1.5833	0.00
1.6667	0.00
1.7500	0.00
1.8333	0.00
1.9167	0.00
2.0000	0.00
2.5000	0.00
3.0000	0.00
3.5000	0.00
4.0000	0.00
4.5000	0.00
5.0000	0.00
5.5000	0.00
6.0000	0.00
6.5000	0.00
7.0000	0.00
7.5000	0.00
8.0000	0.00
8.5000	0.00
9.0000	0.00
9.5000	0.00
10.0000	0.00

END

9330019.1551


WATER LEVEL CHANGE (ft)
-0.00
-0.20
-0.40
-0.60
-0.80
-1.00
-1.20
-1.40
0.00
0.05
0.10
0.15
0.20
0.25
TIME (min)
WELL 299-E27-13, SLUG WITHDRAWAL TEST #1
WELL 299-E27-13, SLUG WITHDRAWAL TEST #2


WELL 299-E27-13, SLUG WITHDRAWAL TEST #1
Yo PROJECTED = 0.56 ft
Yo OBSERVED = 0.53 ft
r_c = 0.2297 ft
EXPONENTIAL BEST FIT LINE; Y = $e^{(-61.84X)}$ * 0.56
K=(r_c^2 ln(R_e/r_w)/2L_et) * ln(Y_o/Y_t)
K=((0.2297)^2 (2.41) / 2(13.9)(0.01)) * ln(0.56/0.30)
K= 410 ft/day
WATER LEVEL CHANGE (Y_t), (ft)
0.1
0.01
0.00
0.01
0.02
0.03
0.04
0.05
0.06
TIME (t), (min)

WELL 299-E27-13, SLUG WITHDRAWAL TEST #1

THE BELOW HYDRAULIC CONDUCTIVITY VALUE WAS CALCULATED
USING THE BOUWER AND RICE SLUG TEST METHOD.
SOURCE= "THE BOUWER AND RICE SLUG TEST-AN UPDATE"
GROUND WATER, VOL 27, NO. 3, MAY-JUNE 1989.

RADIUS OF CASING USED IN CALCULATIONS HAS BEEN
CORRECTED FOR THE THICKNESS OF GRAVEL OR SAND
PACK DUE TO WATER LEVEL CHANGES IN THE SCREEN OR
OPEN INTERVAL OF WELL.

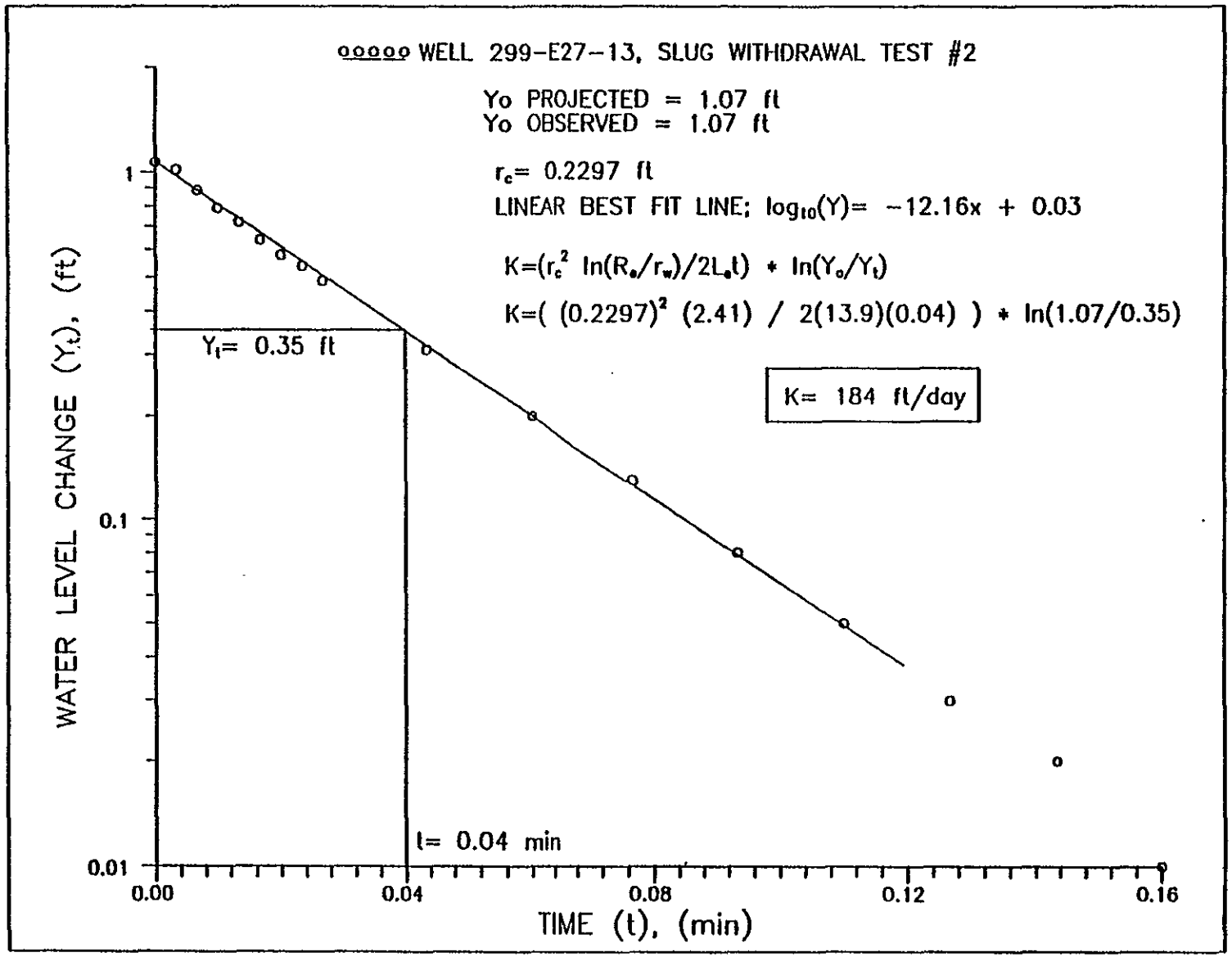
Rc (ft)	Rw (ft)	Le (ft)	Lw (ft)	H (ft)
.2297	.3333	13.9100	13.9100	50.0000

Le/Rw = 41.7300000
A= 2.8929200
B= 4.568365E-001
C= 2.4968560
SANDPACK POROSITY= 3.000000E-001
t (min)= 1.000000E-002
1/t= 100.0000000
Yo= (ft) 5.600000E-001
Yt= (ft) 3.000000E-001
1/t ln(Yo/Yt)= 62.4154300
ln[(H-Lw)/Rw]= 4.6846280
ln(Re/Rw)= 2.4072070

K (ft/day) = 410.4576000

T OF THE SATURATED SCREEN INTERVAL
(ft2/day)= 5709.4660000

9330049.1554


WELL 299-E27-13, SLUG WITHDRAWAL TEST #2
Yo PROJECTED = 1.07 ft
Yo OBSERVED = 1.07 ft
r_c= 0.2297 ft
LINEAR BEST FIT LINE; $\log_{10}(Y)$= −12.16x + 0.03
$K=(r_c^2 \ln(R_e/r_w)/2L_e t) * \ln(Y_o/Y_t)$
$K=((0.2297)^2 (2.41) / 2(13.9)(0.04)) * \ln(1.07/0.35)$
K= 184 ft/day
Y_t= 0.35 ft
t= 0.04 min
WATER LEVEL CHANGE (Y_t), (ft)
TIME (t), (min)
1
0.1
0.01
0.00
0.04
0.08
0.12
0.16

WELL 299-E27-13, SLUG WITHDRAWAL TEST #2

THE BELOW HYDRAULIC CONDUCTIVITY VALUE WAS CALCULATED USING THE BOUWER AND RICE SLUG TEST METHOD.
SOURCE= "THE BOUWER AND RICE SLUG TEST-AN UPDATE"
GROUND WATER, VOL 27, NO. 3, MAY-JUNE 1989.

RADIUS OF CASING USED IN CALCULATIONS HAS BEEN CORRECTED FOR THE THICKNESS OF GRAVEL OR SAND PACK DUE TO WATER LEVEL CHANGES IN THE SCREEN OR OPEN INTERVAL OF WELL.

Rc (ft)	Rw (ft)	Le (ft)	Lw (ft)	H (ft)
.2297	.3333	13.9100	13.9100	50.0000

Le/Rw = 41.7300000
A= 2.8929200
B= 4.568365E-001
C= 2.4968560
SANDPACK POROSITY= 3.000000E-001
t (min)= 4.000000E-002
1/t= 25.0000000
Yo= (ft) 1.0700000
Yt= (ft) 3.500000E-001
1/t ln(Yo/Yt)= 27.9370200
ln[(H-Lw)/Rw]= 4.6846280
ln(Re/Rw)= 2.4072080

K (ft/day) = 183.7176000

T OF THE SATURATED SCREEN INTERVAL
(ft2/day)= 2555.5120000

9318018.1556

APPENDIX F

TEST DATA AND ANALYSIS FOR WELL 299-E27-14

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APPENDIX F

TEST DATA AND ANALYSIS FOR WELL 299-E27-14

This appendix contains the as-built diagram for the well construction, Slug Test Record Form, Aquifer Test Data Sheets, Equipment Record Forms, Electronic Data Control Forms, and accompanying data logs and plots for well 299-E27-14.

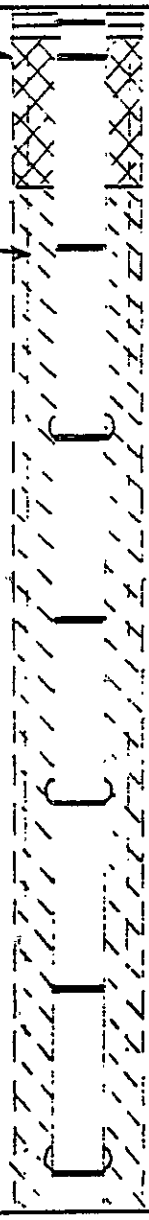
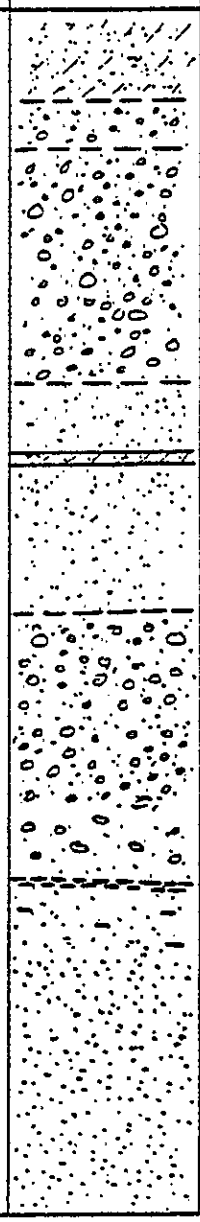
9330010.0552

Battelle
Pacific Northwest Laboratories

AS-BUILT DIAGRAM

Well Number 299-E27-14 Geologist R Miller Page 1 of 3

Reviewed by V.T. Jackson Date 12-7-89

Construction Data		Depth in Feet	Geologic/Hydrologic Data	
Description	Diagram		Diagram Litho.	Lithologic Description
temporary 10" dia carbon steel casing from to 137'-7"		5		Muddy SAND
		10		"
		15		Gravelly SAND
		20		Sandy GRAVEL
		25		"
8" carbon steel temp casing installed to 267.1'		30		"
		35		"
		40		"
		45		SAND
		50		48-49' Slightly Muddy SAND - WET SAND
		55		"
		60		"
		65		"
		70		Sandy GRAVEL
		75		" "
		80		" "
		85		" "
		90		GRAVELLY SAND
		95		SAND (CLAY LENSE 94' to 94.5')
		100		Slightly Muddy SAND
		105		SAND
		110		SAND
		115		SAND
		120		SAND
		125		SAND
		130		SAND

PNL-MA-567 Do-1, REV.0

A-1800-185 (3/87)

9330013.0559

Battelle
Pacific Northwest Laboratories

AS-BUILT DIAGRAM

Well Number 299-E27-14 Geologist M. Lubrecht Page 2 of 3

Reviewed by V.J. Rohay Date 12-7-89

Construction Data		Depth in Feet	Geologic/Hydrologic Data	
Description	Diagram		Diagram Litho.	Lithologic Description
		135		SAND
End 10" @ 137'-7"		140		slightly gravelly SAND
		145		Gravelly SAND
		150		SAND
		155		"
		160		slightly gravelly SAND
		165		SAND
		170		gravelly SAND
		175		" "
		180		" "
8" ea. bow shoe temp		185		" "
casing		190		" "
		195		" "
246.48' of 4" Type 304,		200		sl. gravelly SAND
S.H.5 Stainless Steel		205		SAND
Casing		210		SAND
		215		SAND
		220		"
		225		"
		230		muddy sandy Gravel
		235		Sandy Gravel
		240		" "
		245		Muddy Sandy Gravel
		250		Sandy Gravel
		255		" "
		260		Gravelly SAND

V D/W = 249.91' (10/1/89)

PNL-MA567, DO-1, Rev 0

A-1800-186 (3/87)

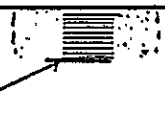
8320013.0668

Battelle
Pacific Northwest Laboratories

AS-BUILT DIAGRAM

Well Number 299-E27-14 Geologist M.D. Lubbreckt Page 3 of 3

Reviewed by W.A. Haskell Date 12-7-89

Construction Data		Depth in Feet	Geologic/Hydrologic Data	
Description	Diagram		Diagram Litho.	Lithologic Description
End 8" Csg. @ 267.1' TDe 266.05'		265'		Sand -
21' of 4" Dia. 10 Slot Channel Pack Screen (Stainless Steel)				T.D. = 266.8' Competion Depth = 266.83
Competion Symbols:				
Cement Grout				
Granular Bentonite				
Bentonite Pellets				
Silica Sand				
Casing Joint				
Casing Centralizer				

DNL-MA-567 DD-1, REV.0 A-1800-186 13.

Aquifer Test Data

WHC-SD-EN-TI-147, Rev. 0

Data for Well 299-E27-14
Pumping Well –
Observation Wells –

Location 200 East, C Tank Farm
Type of Aquifer Test Slug Test
How Q Measured –
How W.L.'s Measured E-tape (S/N 12174), transducer
(Rad)/Dist. of/From Pumping Well 2"
Meas. Point for W.L.'s Top of 4" casing
Elevation of Meas. Point –
Top of 4" casing is 0.55 ft. above ground surface

Depth of Pump/Airpipe –
Pump On: date – time –
Pump Off: date – time –
Duration of Aquifer Test –

Time t = ____ at t' = 0					Water Level Data Static Water Level ____					Discharge		Recorded By	Comments
Day	Clock Time	t	t'	t/t'	Reading	Conversions or Corrections	Water Level	s or s'		Reading	Q		
10/20	0945				250.17'							DRN	E-tape
1	0956				D/B = 263.70 + 2.47' = 266.17'								Need to verify this measur
						Steel tape # L300-14							
	1017				Set	transducer and slug below				static water			slug is completely submer
	1018				16.98'	Set Ref=0		Test # 3					Trans.
	1020					Pull Slug (may be slightly late)							
	1030					Stop datalogger							
					Set	Slug below static water							Slug is completely submer
	1032				16.98'	Set ref= 0		Test # 4					Trans.
	1035					Pull Slug (slightly late)							
	1047					Stop datalogger							
					16.95'	Ref=0		Test # 5					
	1052					Pull slug							
	1103					Stop datalogger							
									DRN	10/20/89		Y	Transducer S/N 259198
						~~to withdraw one bail part~~							Datalogger S/N LKB-701
						Driller will bail well when he sets submersible							

Darrell Reviewed 10/20/89

9320010.1567

Location 200 East, C Tank Farm Date of Test 10/20/89

Well Number 299-E27-14 Procedure Number PNL-MA-567 AT-6, Rev Ø

Type of Test(s) Slug Withdrawal Test

Personnel Conducting Test D.R. Newcomer, Darrell Ludke, KEH driller

WELL CONFIGURATION

Well Depth ~265.6' below ground surface Borehole Diameter 8"

Well Casing Inside Diameter 4" Well Screen Inside Diameter 4"

Length of Screened Interval 16.0' (below water) Depth of Screen 266.8'-245.8' b.l.s.

Comments Well is undeveloped; cement pad has not been poured

SLUG INFORMATION

Slug Construction Materials Carbon Steel Casing

Length of Slug 6.0' Diameter of Slug 2 1/4"

Comments

Volume of Attachments (if applicable)

MEASUREMENT EQUIPMENT INFORMATION

	Make	Model	Serial Number
Electric Tape	Slope Indicator	51453	12174
Steel Tape	Lufkin	Super Hi-way Nubian	L300-14
Data logger	In Situ	SE1000B Hermit	1KB-701
Transducer	Druck	PTX-161D	259198
Other			

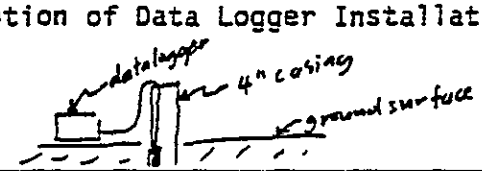
Darrell Newcomer, 10/20/89

9130018.1563

Equipment Record Form for the Installation and Removal of Data Loggers and Pressure Transducers

Initial Check: ok		
Purpose of Installation: To monitor water levels during slug test		
Monitored Hydrologic Unit or Water Body: Upper Unconfined Aquifer within saturated screen interval		
Date/Time of Installation: 10/20/89 1017 hrs	Procedure Followed: PNL-MA-567 WL-4, Rev 0	
Data Logger Make/Model: In Situ/ Hermit SE 1000B		
Serial No.: 1KB-701	Number of Channels Used: 1	
Pressure Transducer Make/Model: Druck / PTX-161D	Full Scale Range: 10 psi	Well No.: 299-E27-14
	Serial No.: 259198	Depth: ~266' below land surface
Pressure Transducer Make/Model:	Full Scale Range:	Well No.:
	Serial No.:	Depth:

Description of Data Logger Installation and Well Head Configuration:



Stickup of 4" casing is 0.55' above land surface

Comments:
Slug was positioned above water before placing the transducer down to bottom. Slug was then lowered into position below water. Water level was allowed to stabilize.

Equipment Installed By	D. R. Newcomer
Date/Time of Equipment Removal:	10/20/89 1705 hrs.
Decontamination Procedure (if required):	
Equipment Removed By	D. R. Newcomer

(5/18/89, Rev. 0)

ELECTRONIC DATA CONTROL FORM

DATE AND START TIME OF DATA ACQUISITION 10/20/89 1020 hrs.

DATE AND END TIME OF DATA ACQUISITION 10/20/89 1030 hrs

WELL NUMBER 299-E27-14

TYPE OF TEST OR DATA Slug Test

TYPE AND IDENTIFICATION NUMBER OF DATA LOGGER In Situ Hermit SE1000B, S/N 1KB-701

TEST NUMBER 3

CHANNEL OR INPUT NUMBER 1

UNITS OF VALUES RECORDED ft

NUMBER OF PAGES ATTACHED 2

COMMENTS: Test 3 = Withdraw Slug

DATA VALIDATION STATEMENT:

The attached data represent the data as originally recorded on the data logger. Any exceptions and reasons for such are indicated in the comments section.

Darrell Newcomer, Scientist — Name, title

10/20/89 — Date

9130180565

Well: 299-E27-14
Test Date: October 20, 1989
Start Time: 10:20

SE1000B
Environmental Logger
10/20 16:01

Unit# 00701 Test# 3

INPUT 1: Level (F)

Reference	0.00
Scale factor	9.99
Offset	- 0.01

Elapsed Time, min	Value, ft
0.0000	0.00
0.0033	0.00
0.0066	- 4.69
0.0099	0.16
0.0133	1.21
0.0166	- 1.66
0.0200	0.03
0.0233	- 0.82
0.0266	- 0.75
0.0300	- 1.21
0.0333	- 1.54
0.0500	- 0.85
0.0666	- 0.54
0.0833	- 0.34
0.1000	- 0.22
0.1166	- 0.14
0.1333	- 0.08
0.1500	- 0.05
0.1666	- 0.03
0.1833	- 0.02
0.2000	- 0.01
0.2166	- 0.00
0.2333	- 0.00
0.2500	0.00
0.2666	0.00
0.2833	0.00
0.3000	0.00
0.3166	0.00
0.3333	0.00
0.4167	0.00
0.5000	0.00
0.5833	0.00
0.6667	0.00
0.7500	0.00
0.8333	0.00
0.9167	0.00
1.0000	0.00
1.0833	0.00
1.1667	0.00
1.2500	0.00
1.3333	0.00
1.4166	0.00
1.5000	0.00
1.5833	0.00
1.6667	0.00
1.7500	0.00
1.8333	0.00
1.9167	0.00
2.0000	0.00
2.5000	0.00
3.0000	0.00
3.5000	0.00
4.0000	0.00
4.5000	0.00
5.0000	0.00
5.5000	0.00
6.0000	0.00
6.5000	0.00
7.0000	0.00
7.5000	0.00
8.0000	0.00
8.5000	0.00
9.0000	0.00
9.5000	0.00
10.0000	0.00

END

9330.156

(5/18/89, Rev. 0)

ELECTRONIC DATA CONTROL FORM

DATE AND START TIME OF DATA ACQUISITION 10/20/89 1035 hrs.

DATE AND END TIME OF DATA ACQUISITION 10/20/89 1047 hrs.

WELL NUMBER 299-E27-14

TYPE OF TEST OR DATA Slug Test

TYPE AND IDENTIFICATION NUMBER OF DATA LOGGER In Situ Hermit SE1000 B, S/N 1KB-701

TEST NUMBER 4

CHANNEL OR INPUT NUMBER 1

UNITS OF VALUES RECORDED ft

NUMBER OF PAGES ATTACHED 2

COMMENTS:
Test 4 = Withdraw Slug

DATA VALIDATION STATEMENT:

The attached data represent the data as originally recorded on the data logger. Any exceptions and reasons for such are indicated in the comments section.

Darrell Newcomer, Scientist — Name, title

10/20/89 — Date

9130019.1567

Well: 299-E27-14
Test Date: October 20, 1989
Start Time: 10:35

SE1000B
Environmental Logger
10/20 16:02

Unit# 00701 Test# 4

INPUT 1: Level (F)

Reference	0.00
Scale factor	9.99
Offset	- 0.01

Elapsed Time, min	Value, ft
0.0000	0.00
0.0033	- 0.00
0.0066	- 0.00
0.0099	- 0.00
0.0133	- 3.67
0.0166	- 0.19
0.0200	0.59
0.0233	- 3.87
0.0266	- 3.00
0.0300	- 4.47
0.0333	- 4.09
0.0500	- 4.32
0.0666	- 3.57
0.0833	- 3.25
0.1000	- 3.05
0.1166	- 2.92
0.1333	- 2.83
0.1500	- 2.78
0.1666	- 2.75
0.1833	- 2.72
0.2000	- 2.71
0.2166	- 2.69
0.2333	- 2.68
0.2500	- 2.67
0.2666	- 2.67
0.2833	- 2.66
0.3000	- 2.66
0.3166	- 2.66
0.3333	- 2.65
0.4167	- 2.63
0.5000	- 2.61
0.5833	- 2.58
0.6667	- 2.56
0.7500	- 2.54
0.8333	- 2.53
0.9167	- 2.50
1.0000	- 2.48
1.0833	- 2.47
1.1667	- 2.45
1.2500	- 2.42
1.3333	- 2.37
1.4166	- 2.35
1.5000	- 2.33
1.5833	- 2.32
1.6667	- 2.30
1.7500	- 2.26
1.8333	- 2.24
1.9167	- 2.21
2.0000	- 2.19
2.5000	- 2.03
3.0000	- 1.92
3.5000	- 1.77
4.0000	- 1.60
4.5000	- 1.29
5.0000	- 1.00
5.5000	- 0.83
6.0000	- 0.73
6.5000	- 0.53
7.0000	0.00
7.5000	- 0.00
8.0000	- 0.00
8.5000	- 0.00
9.0000	- 0.00
9.5000	- 0.00
10.0000	- 0.00
12.0000	- 0.02

END

9301015.1658

(5/18/89, Rev. 0)

ELECTRONIC DATA CONTROL FORM

DATE AND START TIME OF DATA ACQUISITION 10/20/89 1052 hrs.

DATE AND END TIME OF DATA ACQUISITION 10/20/89 1102 hrs.

WELL NUMBER 299-E27-14

TYPE OF TEST OR DATA Slug Test

TYPE AND IDENTIFICATION NUMBER OF DATA LOGGER In Situ Hermit SE1000B . S/N 1KB-701

TEST NUMBER 5

CHANNEL OR INPUT NUMBER 1

UNITS OF VALUES RECORDED Ft

NUMBER OF PAGES ATTACHED 2

COMMENTS: Test 5 = Withdraw Slug

DATA VALIDATION STATEMENT:

The attached data represent the data as originally recorded on the data logger. Any exceptions and reasons for such are indicated in the comments section.

Darrell Newcomer, Scientist — Name, title

10/20/89 — Date

9330019.1569

Well: 299-E27-14
Test Date: October 20, 1989
Start Time: 10:52

SE1000B
Environmental Logger
10/20 16:04

Unit# 00701 Test# 5

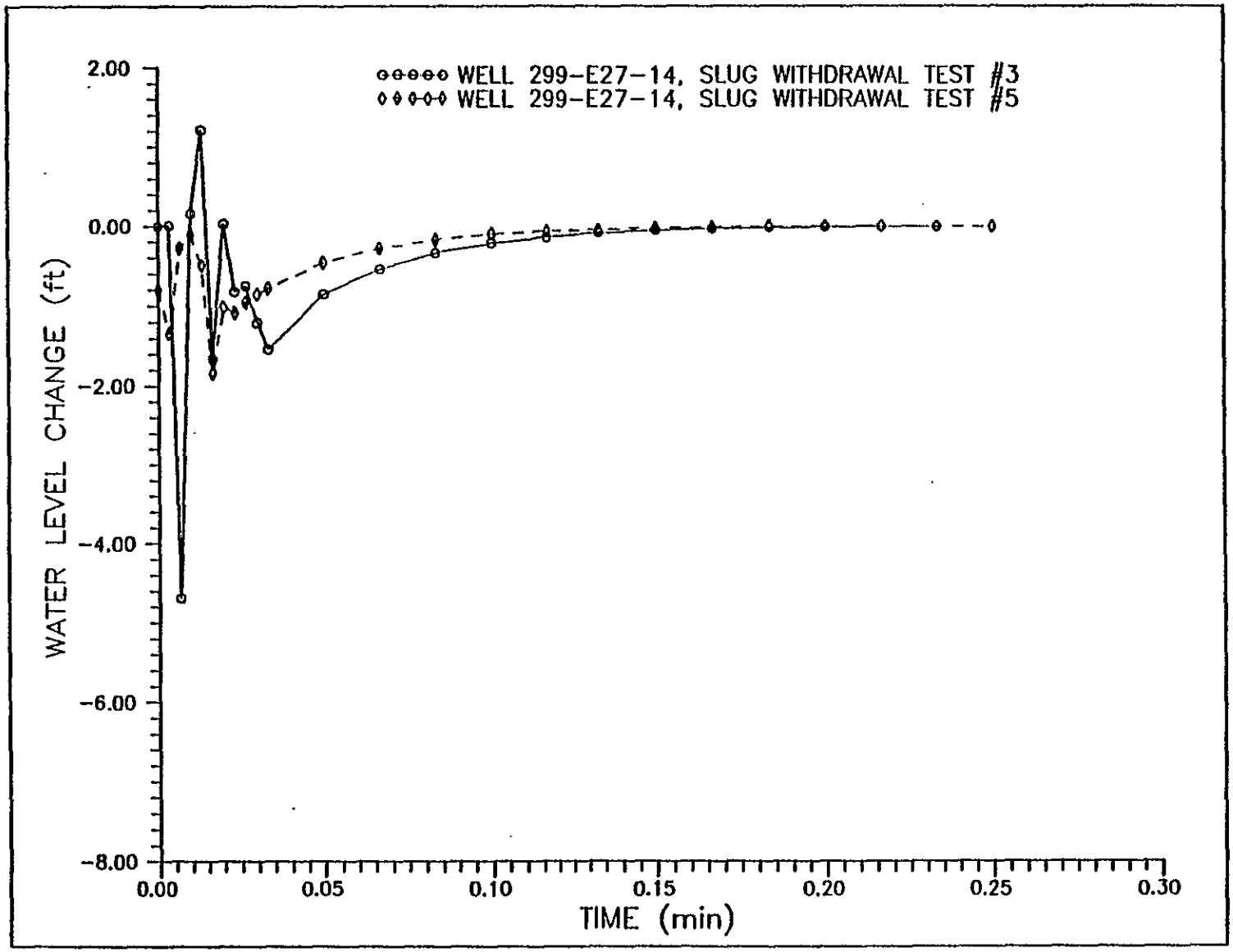
INPUT 1: Level (F)

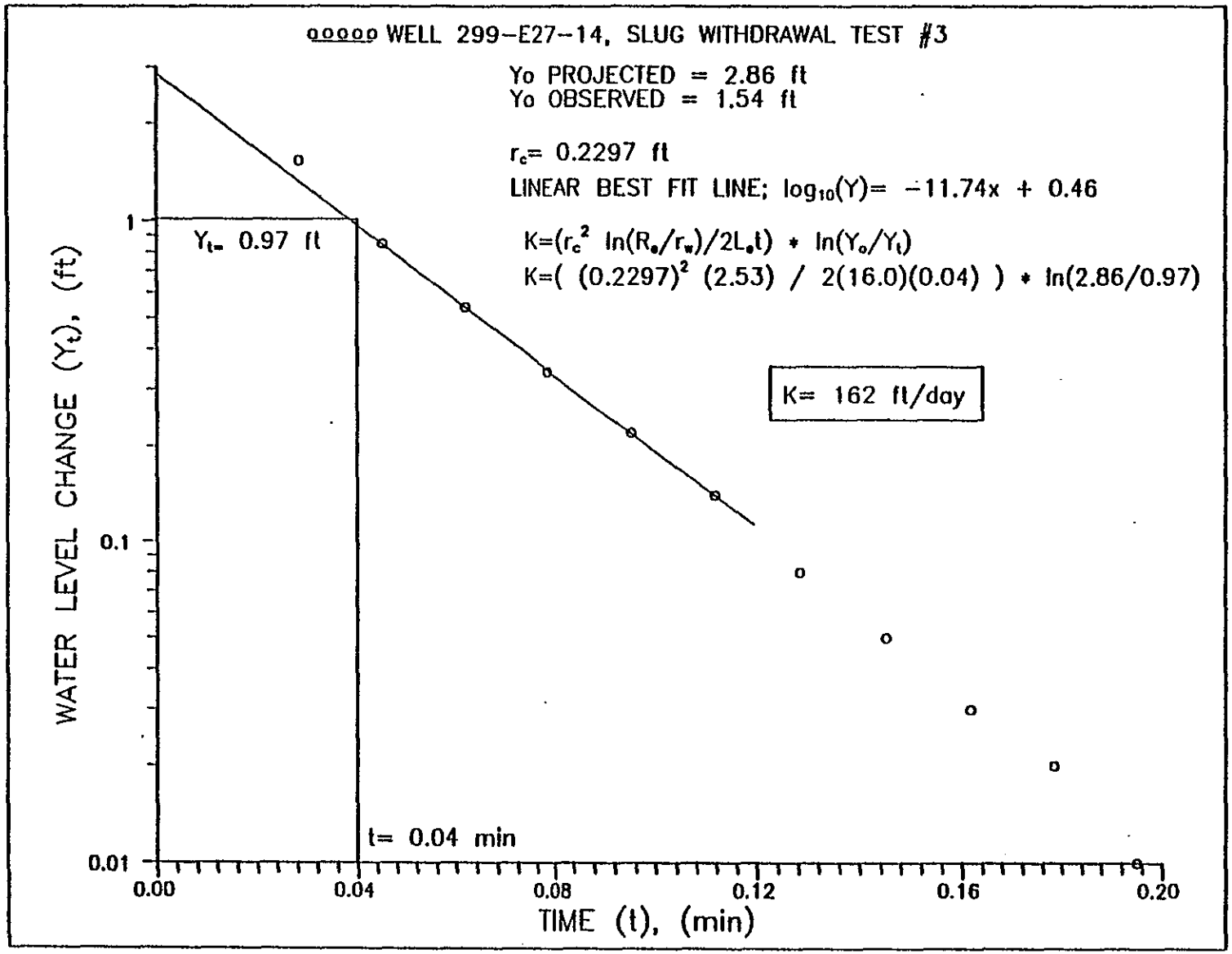
Reference	0.00
Scale factor	9.99
Offset	- 0.01

Elapsed Time, min	Value, ft
0.0000	- 0.80
0.0033	- 1.35
0.0066	- 0.28
0.0099	- 0.11
0.0133	- 0.49
0.0166	- 1.84
0.0200	- 1.01
0.0233	- 1.08
0.0266	- 0.95
0.0300	- 0.85
0.0333	- 0.77
0.0500	- 0.46
0.0666	- 0.28
0.0833	- 0.17
0.1000	- 0.10
0.1166	- 0.06
0.1333	- 0.04
0.1500	- 0.02
0.1666	- 0.01
0.1833	- 0.00
0.2000	- 0.00
0.2166	- 0.00
0.2333	- 0.00
0.2500	0.00
0.2666	0.00
0.2833	0.00
0.3000	0.00
0.3166	0.00
0.3333	0.00
0.4167	0.00
0.5000	0.00
0.5833	0.00
0.6667	0.00
0.7500	0.00
0.8333	0.00
0.9167	0.00
1.0000	0.00
1.0833	0.00
1.1667	0.00
1.2500	0.00
1.3333	0.00
1.4166	0.00
1.5000	0.00
1.5833	0.00
1.6667	0.00
1.7500	0.00
1.8333	0.00
1.9167	0.00
2.0000	0.00
2.5000	0.00
3.0000	0.00
3.5000	0.00
4.0000	0.00
4.5000	0.00
5.0000	0.00
5.5000	0.00
6.0000	0.00
6.5000	0.01
7.0000	0.00
7.5000	0.01
8.0000	0.00
8.5000	0.00
9.0000	0.00
9.5000	0.00
10.0000	0.00

END

9330813.575


WELL 299-E27-14, SLUG WITHDRAWAL TEST #3
WELL 299-E27-14, SLUG WITHDRAWAL TEST #5
WATER LEVEL CHANGE (ft)
2.00
0.00
-2.00
-4.00
-6.00
-8.00
0.00
0.05
0.10
0.15
0.20
0.25
0.30
TIME (min)


WELL 299-E27-14, SLUG WITHDRAWAL TEST #3
Yo PROJECTED = 2.86 ft
Yo OBSERVED = 1.54 ft
r_c= 0.2297 ft
LINEAR BEST FIT LINE; $\log_{10}(Y)$= -11.74x + 0.46
$K=(r_c^2 \ln(R_e/r_w)/2L_e t) * \ln(Y_o/Y_t)$
$K=((0.2297)^2 (2.53) / 2(16.0)(0.04)) * \ln(2.86/0.97)$
K= 162 ft/day
Y_t= 0.97 ft
t= 0.04 min
WATER LEVEL CHANGE (Y_t), (ft)
TIME (t), (min)
1
0.1
0.01
0.00
0.04
0.08
0.12
0.16
0.20

WELL 299-E27-14, SLUG WITHDRAWAL TEST #3

****

THE BELOW HYDRAULIC CONDUCTIVITY VALUE WAS CALCULATED
USING THE BOUWER AND RICE SLUG TEST METHOD.
SOURCE= "THE BOUWER AND RICE SLUG TEST-AN UPDATE"
GROUND WATER, VOL 27, NO. 3, MAY-JUNE 1989.

****

****

RADIUS OF CASING USED IN CALCULATIONS HAS BEEN
CORRECTED FOR THE THICKNESS OF GRAVEL OR SAND
PACK DUE TO WATER LEVEL CHANGES IN THE SCREEN OR
OPEN INTERVAL OF WELL.

****

Rc (ft)	Rw (ft)	Le (ft)	Lw (ft)	H (ft)
.2297	.3333	16.0000	16.0000	50.0000

****

Le/Rw = 48.0000000
A= 3.0530930
B= 4.990199E-001
C= 2.6303630
SANDPACK POROSITY= 3.000000E-001
t (min)= 4.000000E-002
1/t= 25.0000000
Yo= (ft) 2.8600000
Yt= (ft) 9.700000E-001
1/t ln(Yo/Yt)= 27.0320200
ln[(H-Lw)/Rw]= 4.6249730
ln(Re/Rw)= 2.5262860

****

K (ft/day) = 162.1902000

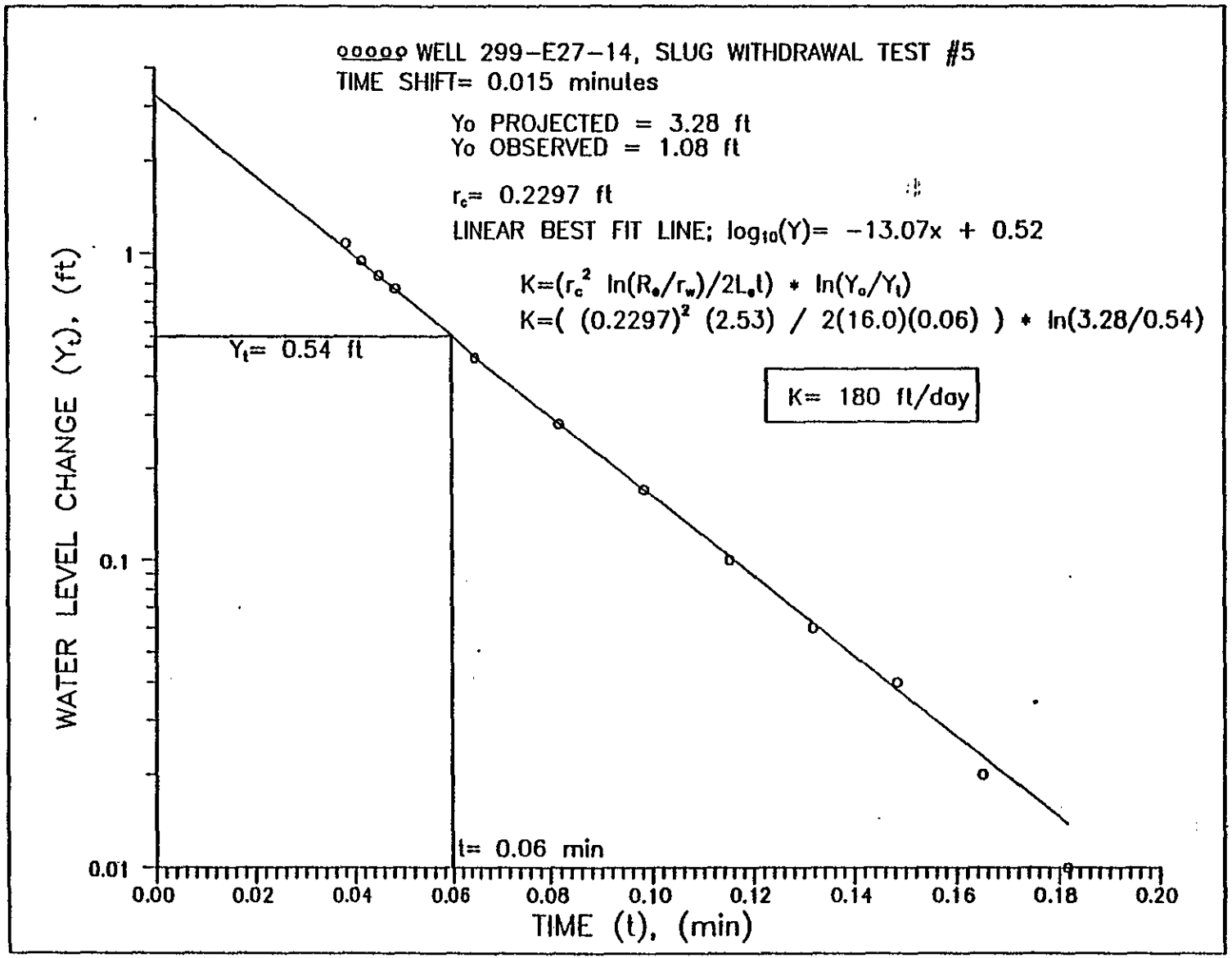
****

T OF THE SATURATED SCREEN INTERVAL
(ft2/day)= 2595.0440000

****

9913018.1573

9313018.0570



WELL 299-E27-14, SLUG WITHDRAWAL TEST #5, TIME SHIFT= 0.015 min

THE BELOW HYDRAULIC CONDUCTIVITY VALUE WAS CALCULATED
USING THE BOUWER AND RICE SLUG TEST METHOD.
SOURCE= "THE BOUWER AND RICE SLUG TEST-AN UPDATE"
GROUND WATER, VOL 27, NO. 3, MAY-JUNE 1989.

RADIUS OF CASING USED IN CALCULATIONS HAS BEEN
CORRECTED FOR THE THICKNESS OF GRAVEL OR SAND
PACK DUE TO WATER LEVEL CHANGES IN THE SCREEN OR
OPEN INTERVAL OF WELL.

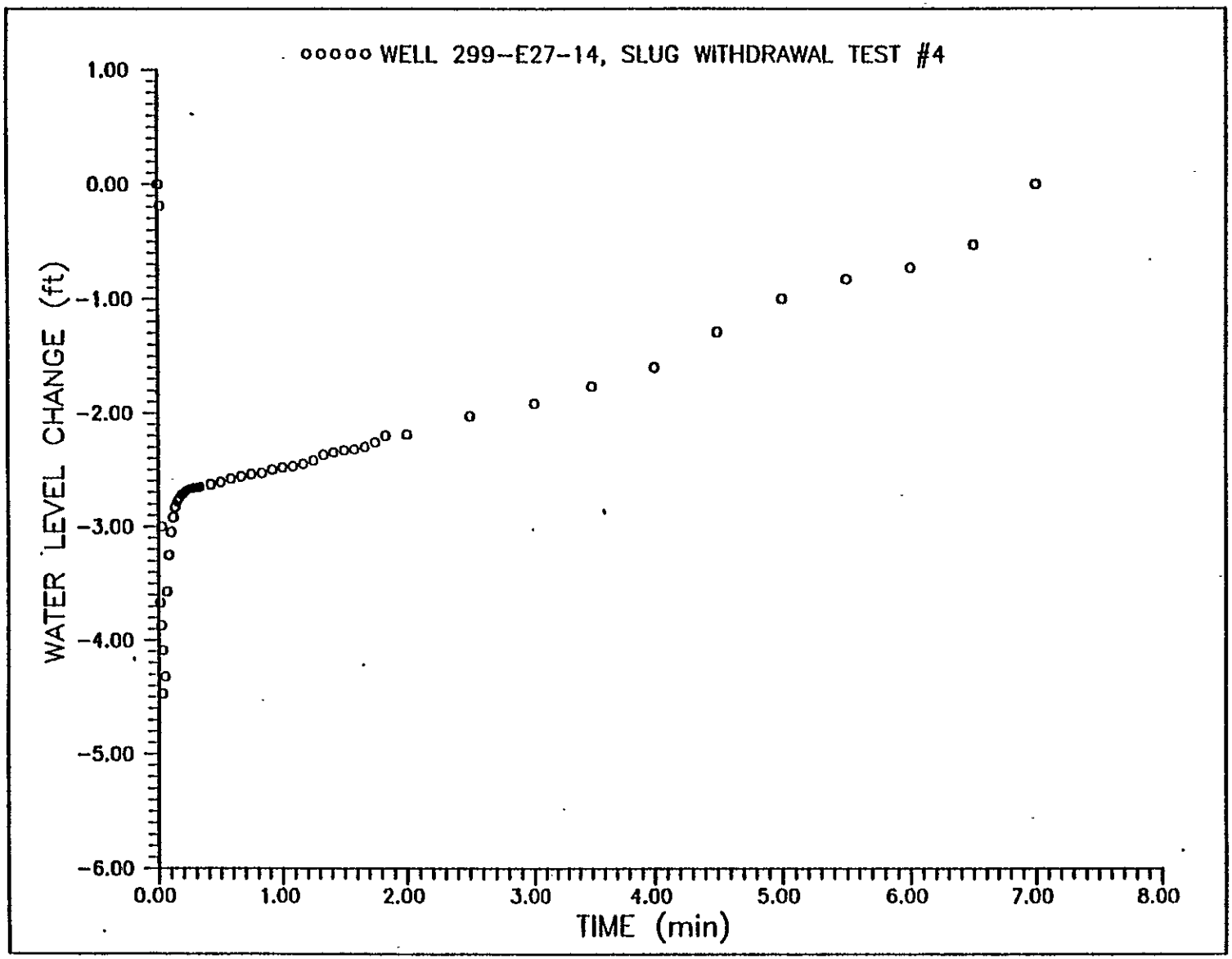
Rc (ft)	Rw (ft)	Le (ft)	Lw (ft)	H (ft)
.2297	.3333	16.0000	16.0000	50.0000

Le/Rw = 48.0000000
A= 3.0530930
B= 4.990199E-001
C= 2.6303630
SANDPACK POROSITY= 3.000000E-001
t (min)= 6.000000E-002
1/t= 16.6666700
Yo= (ft) 3.2800000
Yt= (ft) 5.400000E-001
1/t ln(Yo/Yt)= 30.0671600
ln[(H-Lw)/Rw]= 4.6249730
ln(Re/Rw)= 2.5262860

K (ft/day) = 180.4008000

T OF THE SATURATED SCREEN INTERVAL
(ft2/day)= 2886.4140000

9313018.0575


WELL 299--E27-14, SLUG WITHDRAWAL TEST #4
WATER LEVEL CHANGE (ft)
1.00
0.00
-1.00
-2.00
-3.00
-4.00
-5.00
-6.00
0.00
1.00
2.00
3.00
4.00
5.00
6.00
7.00
8.00
TIME (min)

WELL 299-E27-14, SLUG WITHDRAWAL TEST #4, WATER LEVEL CHANGE SHIFT= -2.66 ft

THE BELOW HYDRAULIC CONDUCTIVITY VALUE WAS CALCULATED
USING THE BOUWER AND RICE SLUG TEST METHOD.
SOURCE= "THE BOUWER AND RICE SLUG TEST-AN UPDATE"
GROUND WATER, VOL 27, NO. 3, MAY-JUNE 1989.

RADIUS OF CASING USED IN CALCULATIONS HAS BEEN
CORRECTED FOR THE THICKNESS OF GRAVEL OR SAND
PACK DUE TO WATER LEVEL CHANGES IN THE SCREEN OR
OPEN INTERVAL OF WELL.

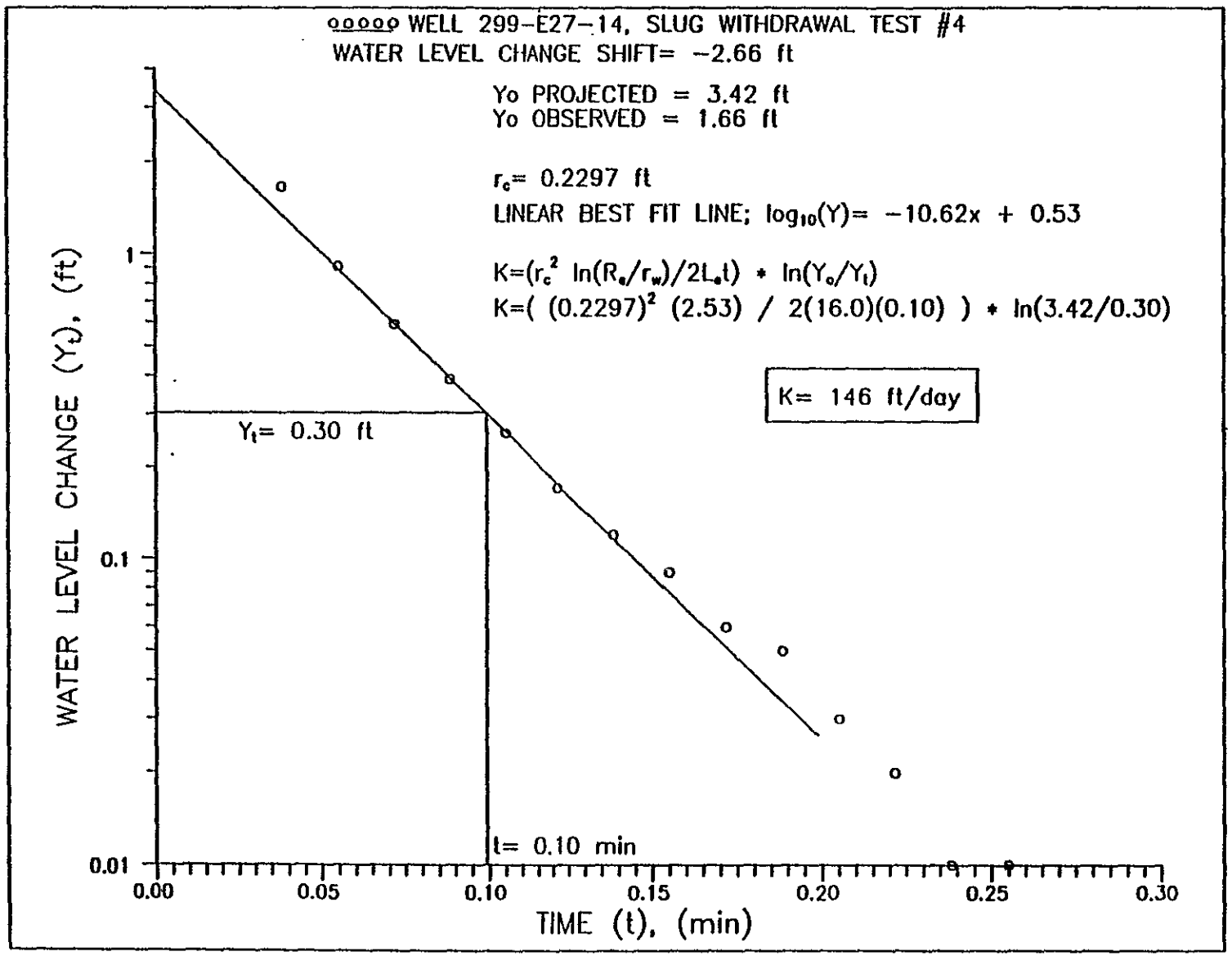
Rc (ft)	Rw (ft)	Le (ft)	Lw (ft)	H (ft)
.2297	.3333	16.0000	16.0000	50.0000

Le/Rw = 48.0000000
A= 3.0530930
B= 4.990199E-001
C= 2.6303630
SANDPACK POROSITY= 3.000000E-001
t (min)= 1.000000E-001
1/t= 10.0000000
Yo= (ft) 3.4200000
Yt= (ft) 3.000000E-001
1/t ln(Yo/Yt)= 24.3361300
ln[(H-Lw)/Rw]= 4.6249730
ln(Re/Rw)= 2.5262860

K (ft/day) = 146.0151000

T OF THE SATURATED SCREEN INTERVAL
(ft2/day)= 2336.2410000

5330029677


WELL 299-E27-14, SLUG WITHDRAWAL TEST #4
WATER LEVEL CHANGE SHIFT= -2.66 ft
Yo PROJECTED = 3.42 ft
Yo OBSERVED = 1.66 ft
r_c= 0.2297 ft
LINEAR BEST FIT LINE; $\log_{10}(Y)$= -10.62x + 0.53
$K=(r_c^2 \ln(R_e/r_w)/2L_e t) * \ln(Y_o/Y_t)$
K=($(0.2297)^2$ (2.53) / 2(16.0)(0.10)) * ln(3.42/0.30)
K= 146 ft/day
Y_t= 0.30 ft
t= 0.10 min
WATER LEVEL CHANGE (Y), (ft)
1
0.1
0.01
0.00
0.05
0.10
0.15
0.20
0.25
0.30
TIME (t), (min)

APPENDIX G

TEST DATA AND ANALYSIS FOR WELL 299-E27-15

9353018.1572

APPENDIX G

TEST DATA AND ANALYSIS FOR WELL 299-E27-15

This appendix contains the as-built diagram for the well construction, Slug Test Record Form, Aquifer Test Data Sheets, Equipment Record Forms, Electronic Data Control Forms, and accompanying data logs and plots for well 299-E27-15.

9313013.1590

Battelle
Pacific Northwest Laboratories

AS-BUILT DIAGRAM

Well Number 299-E27-15 Geologist Jan Kennedy / Miller Page 1 of 2

Reviewed by T.L. McKeehan Date 12-7-89

Construction Data		Depth in Feet	Geologic/Hydrologic Data	
Description	Diagram		Diagram Litho.	Lithologic Description
temporary 10" carbon steel temporary casing w/drive shoe from +1'1" to 128'4½" (129'5½")		5		SAND
		10		"
		15		Sandy gravel
		20		sand
		25		"
temporary 8" carbon steel casing w/ drive shoe from +2.25' to 261.87' bks (264.12')		30		"
		35		Gravelly sand
		40		slightly gravelly sand
240.46' of 4" STAINLESS STEEL CASING		45		Sand
		50		Slightly gravelly sand
		55		"
		60		Sand (tr gravel)
		65		"
		70		"
		75		"
		80		"
		85		"
		90		"
		95		"
		100		"
		105		Gravelly SAND
		110		"
		115		"
		120		"
		125		"
		130		"

PNL MA-567 DO-1, rev 0

A-1800-186 (3/

9215013.1655

Battelle
Pacific Northwest Laboratories

AS-BUILT DIAGRAM

Well Number 299-E27-15 Geologist Kennedy / Miller Page 2 of 2

Reviewed by D.K. McElroy Date 12-7-89

Construction Data		Depth in Feet	Geologic/Hydrologic Data	
Description	Diagram		Diagram Litho.	Lithologic Description
temporary 6" carbon steel casing		135		Sandy Gravel
240.48' of 4"		140		Sand
STAINLESS STEEL CASING		145		Slightly Gravelly Sand
		150		"
		155		Sand
		160		Slightly gravelly sand
		165		"
		170		Sandy GRAVEL
		175		Gravelly SAND
		180		SAND
		185		"
		190		"
		195		"
		200		"
Cement Grout		205		"
8-20 mesh Bentonite Crumbles		210		"
1/4" bentonite Pellets		215		"
16-30 mesh Silica Sand		220		"
		225		"
volcley pellets (1/4")		230		Sandy GRAVEL
		235		"
		240		"
Colorado Silica Sand	240.48'	245		Muddy Sandy GRAVEL
6" stainless steel		250		"
10 slot channel pack (21')		255		"
		260		"

TD 262.54'

PNL-MA-567-DC-1-REV-0

A-1800-185 (3/87)

9330010.1583

Aquifer Test Data

Data for Well 299-E27-15
Pumping Well –
Observation Wells –

Location 200 East Area, C Tank Farm
Type of Aquifer Test Slug Test
How Q Measured –
How W.L.'s Measured E-tape (S/N 12174), transducer
Rad/Dist. of From Pumping Well 2"
Meas. Point for W.L.'s Top of 6" I.D. casing
Elevation of Meas. Point
Top of 6" casing is 2.83' above top of cement pad

Depth of Pump/Airpipe –
Pump On: date – time
Pump Off: date – time
Duration of Aquifer Test –

Time: t = ____ at t' = 0
Water Level Data: Static Water Level ____

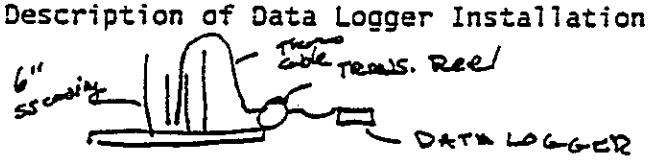
Day	Clock Time	t	t'	t/t'	Reading	Conversions or Corrections	Water Level	s or s'		Discharge Reading	Q	Recorded By	Comments
10/19	0940				248.04'							DRN	E-tape
	0945					D/B is 279.28' + 2.47' = 281.67' below TOC							Steel tape #L300-14
						D/B Measurement incorrect DRN 10/26/89							
					Slug is 6' in length and 2¼" in diameter								Datalogger S/N 1KB-701
													Transducer S/N 259198
					Set bottom of slug to 247.5' from TOC								
	1025				Ref set to 0.0 @ 13.93'			SC1 Ø		Set clock			
	1028				Drop slug (it was released late)								
	1032				Stop datalogger								
					Lost data on Test Ø								
	1148				D/B was measured incorrected							JVB	
					transducer set just above bottom								
	1150				13.78	trans reading							
	1150.30				13.79								
	1151				13.80								
	1152				13.81	ref set							
					TEST Ø		dropped at log 2						
	1237				Stopped test 0								
	1241				start test 1		ref same as test 0 w/D						
	1257				Stopped test 1								
					13.85' trans								
	1258				13.86	ref. set							
	1301				~~start~~ test 2		injection						
	1323				Stopped test 2								
					13.91'	ref. set							
					~~start test 3~~								
	1327				Start test 3		~~started~~ w/D slug a little late						
	1339				Stopped test 3								
~~10/20~~	~~0733~~ DRN 10/20/89				~~13.11'~~ DRN								~~trans.~~ DRN
										Jil Bergham 10/19/89			

93130 1583

Equipment Record Form for the Installation and Removal of Data Loggers and Pressure Transducers

Initial Check: IN LAB		
Purpose of Installation: Monitored WL changes during Slug tests		
Monitored Hydrologic Unit or Water Body: saturated screened interval		
Date/Time of Installation: 5/19/89 1020	Procedure Followed: WL-4	
Data Logger Make/Model: Hermit SE 1000B		
Serial No.: 1KB-701	Number of Channels Used: 1	
Pressure Transducer Make/Model: In situ PTX-161D	Full Scale Range: 10 psi	Well No.: 299-E27-15
	Serial No.: 259198	Depth: 13.7 ft below water
Pressure Transducer Make/Model:	Full Scale Range:	Well No.:
	Serial No.:	Depth:

Description of Data Logger Installation and Well Head Configuration:



Comments:

Equipment Installed By	D R. Dowcomen
Date/Time of Equipment Removal:	10/19/89 1230
Decontamination Procedure (if required):	N/A
Equipment Removed By	JV Borg/Lee

Location 1-TANK 2-EAST Date of Test 10/19/89

Well Number 299-E27-15 Procedure Number AT-6

Type of Test(s) Slug

Personnel Conducting Test Borghese, Newcomer

WELL CONFIGURATION

Well Depth 261' TOC Borehole Diameter 4" 8"

Well Casing Inside Diameter 4" Well Screen Inside Diameter 4"

Length of Screened Interval ~~10.65~~ 20' Depth of Screen ~ 241-261

Comments well is undeveloped

SLUG INFORMATION

Slug Construction Materials carbon steel

Length of Slug 6' Diameter of Slug 2.25 inch

Comments

Volume of Attachments (if applicable)

MEASUREMENT EQUIPMENT INFORMATION

	Make	Model	Serial Number
Electric Tape			
Steel Tape			
Data logger			
Transducer			
Other			

on Ag lab form and equipment record form.
JVB 10/20/89

9330.0505

(5/18/89, Rev. 0)

ELECTRONIC DATA CONTROL FORM

DATE AND START TIME OF DATA ACQUISITION 10/19/89 ~1152 (1156)

DATE AND END TIME OF DATA ACQUISITION 10/19/89 1237

WELL NUMBER 299 - E27-15

TYPE OF TEST OR DATA Slug Injection

TYPE AND IDENTIFICATION NUMBER OF DATA LOGGER

Hermit SE 1000B 1KB-701

TEST NUMBER 0

CHANNEL OR INPUT NUMBER 1

UNITS OF VALUES RECORDED Ft from ref. level

NUMBER OF PAGES ATTACHED 7

COMMENTS:

Data Logger started late.

DATA VALIDATION STATEMENT:

The attached data represent the data as originally recorded on the data logger. Any exceptions and reasons for such are indicated in the comments section.

James V Boyle, Geologist — 10/20/89

Name, title — Date

9313018.1596

Well: 299-E27-15
Test Date: October 19, 1989
Start Time: 11:56

SE1000B
Environmental Logger
10/19 16:44

Unit# 00701 Test# 0

INPUT 1: Level (F)

Reference	0.00
Scale factor	9.99
Offset	-0.01

Elapsed Time, min	Value, ft
0.0000	- 0.00
0.0033	- 0.00
0.0066	- 0.00
0.0099	- 0.00
0.0133	- 0.00
0.0166	- 0.00
0.0200	- 0.00
0.0233	- 0.00
0.0266	- 0.00
0.0300	- 0.00
0.0333	- 0.00
0.0500	- 0.00
0.0666	0.28
0.0833	1.08
0.1000	- 0.57
0.1166	0.10
0.1333	0.00
0.1500	0.00
0.1666	0.00
0.1833	0.00
0.2000	0.00
0.2166	0.00
0.2333	0.00
0.2500	0.00
0.2666	0.00
0.2833	0.00
0.3000	0.00
0.3166	0.00
0.3333	0.00
0.4167	0.00
0.5000	0.00
0.5833	0.00
0.6667	0.00
0.7500	0.00
0.8333	0.00
0.9167	0.00
1.0000	0.00
1.0833	0.00
1.1667	0.00
1.2500	0.00
1.3333	0.00
1.4166	0.00
1.5000	0.00
1.5833	0.00
1.6667	0.00
1.7500	0.00
1.8333	0.00
1.9167	0.00
2.0000	0.00
2.5000	0.00
3.0000	0.00
3.5000	0.00
4.0000	0.00
4.5000	0.00
5.0000	0.00
5.5000	0.00
6.0000	0.00
6.5000	0.00
7.0000	0.00
7.5000	0.00
8.0000	0.00
8.5000	0.00
9.0000	0.00
9.5000	0.00
10.0000	0.00
12.0000	0.01
14.0000	0.01
16.0000	0.01
18.0000	0.01
20.0000	0.01
22.0000	0.01
24.0000	0.01
26.0000	0.01
28.0000	0.01
30.0000	0.01
32.0000	0.01
34.0000	0.02
36.0000	0.02
38.0000	0.02
40.0000	0.02

END

9230 0158

(5/18/89, Rev. 0)

ELECTRONIC DATA CONTROL FORM

DATE AND START TIME OF DATA ACQUISITION 10/19/89 1241

DATE AND END TIME OF DATA ACQUISITION " 1257

WELL NUMBER 299-E27-15

TYPE OF TEST OR DATA Slug wD

TYPE AND IDENTIFICATION NUMBER OF DATA LOGGER

Hermit SE1000B 1KB-701

TEST NUMBER 1

CHANNEL OR INPUT NUMBER 1

UNITS OF VALUES RECORDED ft from ref. level

NUMBER OF PAGES ATTACHED 2

COMMENTS:

DATA VALIDATION STATEMENT:

The attached data represent the data as originally recorded on the data logger. Any exceptions and reasons for such are indicated in the comments section.

Jane V. Beyhurst Scientist 10/20/89

Name, title Date

9313099.0529

Well: 299-E27-15
Test Date: October 19, 1989
Start Time: 12:41

SE1000B
Environmental Logger
10/19 16:46

Unit# 00701 Test# 1

INPUT 1: Level (F)

Reference	0.00
Scale factor	9.99
Offset	- 0.01

Elapsed Time, min	Value, ft
0.0000	- 0.06
0.0033	- 0.51
0.0066	- 0.74
0.0099	- 1.01
0.0133	- 0.78
0.0166	- 0.64
0.0200	- 0.52
0.0233	- 0.42
0.0266	- 0.35
0.0300	- 0.26
0.0333	- 0.22
0.0500	- 0.09
0.0666	- 0.04
0.0833	- 0.02
0.1000	- 0.02
0.1166	- 0.01
0.1333	- 0.01
0.1500	- 0.01
0.1666	- 0.01
0.1833	- 0.01
0.2000	- 0.01
0.2166	- 0.01
0.2333	- 0.01
0.2500	- 0.01
0.2666	- 0.01
0.2833	- 0.01
0.3000	- 0.01
0.3166	- 0.01
0.3333	- 0.01
0.4167	- 0.01
0.5000	- 0.01
0.5833	- 0.01
0.6667	- 0.01
0.7500	- 0.01
0.8333	- 0.01
0.9167	- 0.01
1.0000	- 0.01
1.0833	- 0.01
1.1667	- 0.01
1.2500	- 0.01
1.3333	- 0.01
1.4166	- 0.01
1.5000	- 0.01
1.5833	- 0.01
1.6667	- 0.01
1.7500	- 0.01
1.8333	- 0.01
1.9167	- 0.01
2.0000	- 0.01
2.5000	- 0.01
3.0000	- 0.01
3.5000	- 0.01
4.0000	- 0.01
4.5000	- 0.01
5.0000	- 0.01
5.5000	- 0.01
6.0000	- 0.01
6.5000	- 0.00
7.0000	- 0.00
7.5000	- 0.00
8.0000	- 0.00
8.5000	- 0.00
9.0000	- 0.00
9.5000	- 0.00
10.0000	- 0.00
12.0000	- 0.00
14.0000	- 0.00
16.0000	- 0.00

END

9130089.0589

(5/18/89, Rev. 0)

ELECTRONIC DATA CONTROL FORM

DATE AND START TIME OF DATA ACQUISITION 10/19/89 1301

DATE AND END TIME OF DATA ACQUISITION " 1323

WELL NUMBER 299-E27-15

TYPE OF TEST OR DATA Slug ~~in~~ injection

TYPE AND IDENTIFICATION NUMBER OF DATA LOGGER

Uenmit SE1000B 1KR-701

TEST NUMBER 2

CHANNEL OR INPUT NUMBER 1

UNITS OF VALUES RECORDED ft from ref. level

NUMBER OF PAGES ATTACHED 2

COMMENTS:

STARTED Recording Late

DATA VALIDATION STATEMENT:

The attached data represent the data as originally recorded on the data logger. Any exceptions and reasons for such are indicated in the comments section.

J.V. Borghese Scientist — 10/20/89

Name, title — Date

9313018.0504

Well: 299-E27-15
Test Date: October 19, 1989
Start Time: 13:01

SE1000B
Environmental Logger
10/19 16:48

Unit# 00701 Test# 2

INPUT 1: Level (F)

Reference	0.00
Scale factor	9.99
Offset	- 0.01

Elapsed Time, min	Value, ft
0.0000	1.25
0.0033	1.65
0.0066	- 1.03
0.0099	- 0.14
0.0133	- 0.03
0.0166	0.00
0.0200	0.02
0.0233	0.03
0.0266	0.02
0.0300	0.02
0.0333	0.01
0.0500	0.00
0.0666	0.00
0.0833	0.01
0.1000	0.01
0.1166	0.01
0.1333	0.01
0.1500	0.01
0.1666	0.01
0.1833	0.01
0.2000	0.01
0.2166	0.01
0.2333	0.01
0.2500	0.01
0.2666	0.01
0.2833	0.01
0.3000	0.01
0.3166	0.01
0.3333	0.01
0.4167	0.01
0.5000	0.01
0.5833	0.01
0.6667	0.01
0.7500	0.01
0.8333	0.01
0.9167	0.01
1.0000	0.01
1.0833	0.01
1.1667	0.01
1.2500	0.01
1.3333	0.01
1.4166	0.01
1.5000	0.01
1.5833	0.01
1.6667	0.01
1.7500	0.01
1.8333	0.01
1.9167	0.01
2.0000	0.01
2.5000	0.01
3.0000	0.01
3.5000	0.00
4.0000	0.01
4.5000	0.00
5.0000	0.00
5.5000	0.00
6.0000	0.00
6.5000	0.00
7.0000	0.00
7.5000	0.00
8.0000	0.00
8.5000	0.00
9.0000	0.00
9.5000	0.00
10.0000	0.00
12.0000	0.00
14.0000	0.00
16.0000	0.00
18.0000	0.00
20.0000	0.00
22.0000	- 0.00

END

8930859

(5/18/89, Rev. 0)

ELECTRONIC DATA CONTROL FORM

DATE AND START TIME OF DATA ACQUISITION 10/19/89 1327

DATE AND END TIME OF DATA ACQUISITION " 1339

WELL NUMBER 299-E27-15

TYPE OF TEST OR DATA Slug WD

TYPE AND IDENTIFICATION NUMBER OF DATA LOGGER

Hermit SE10008 KB-701

TEST NUMBER 3

CHANNEL OR INPUT NUMBER 1

UNITS OF VALUES RECORDED ft from ref. level

NUMBER OF PAGES ATTACHED 2

COMMENTS:

Trans. hung up

DATA VALIDATION STATEMENT:

The attached data represent the data as originally recorded on the data logger. Any exceptions and reasons for such are indicated in the comments section.

Sara V. Boyles, Scientist — 10/20/89

Name, title — Date

9213110.1692

Well: 299-E27-15
Test Date: October 19, 1989
Start Time: 13:27

SE1000B
Environmental Logger
10/19 16:49

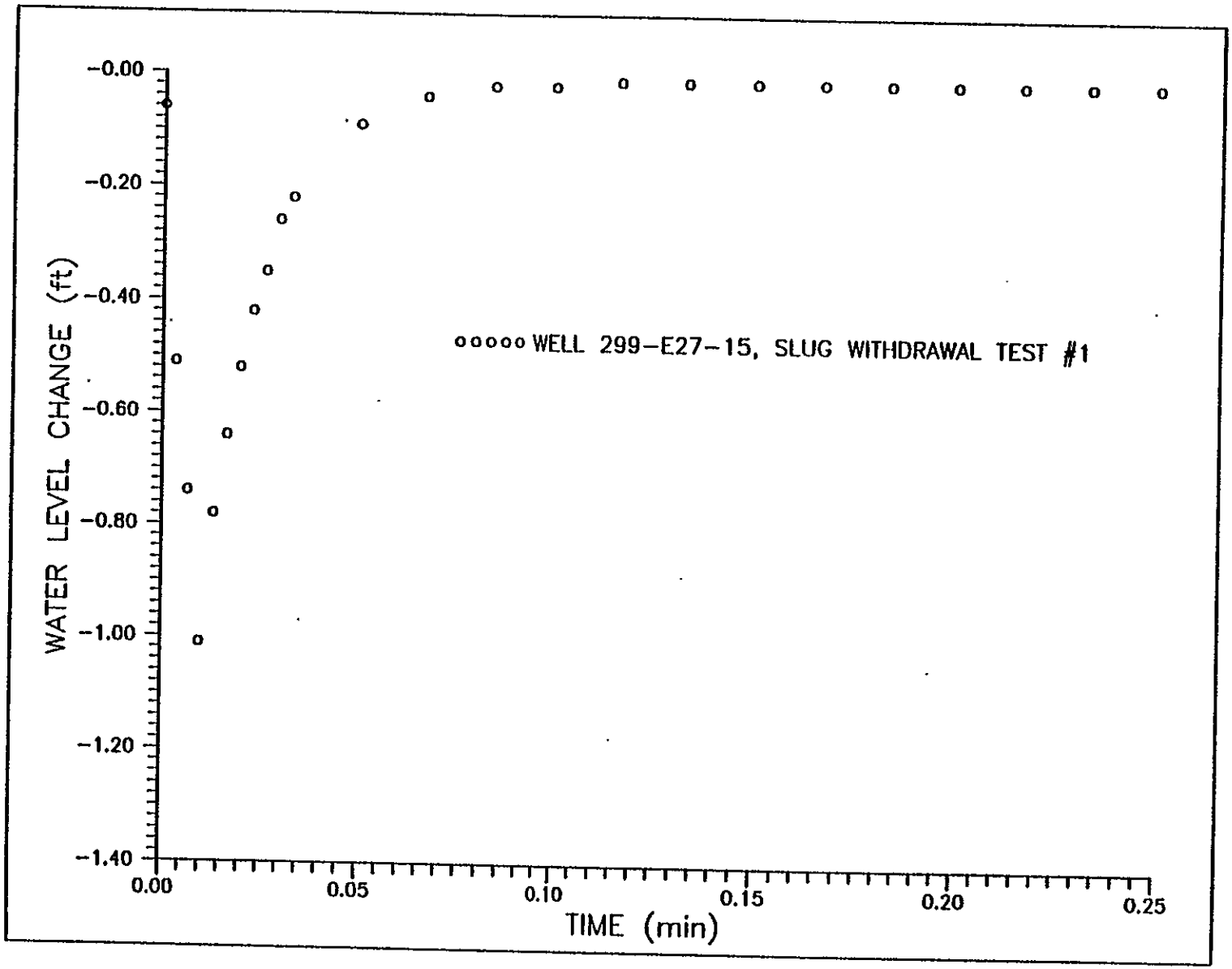
Unit# 00701 Test# 3

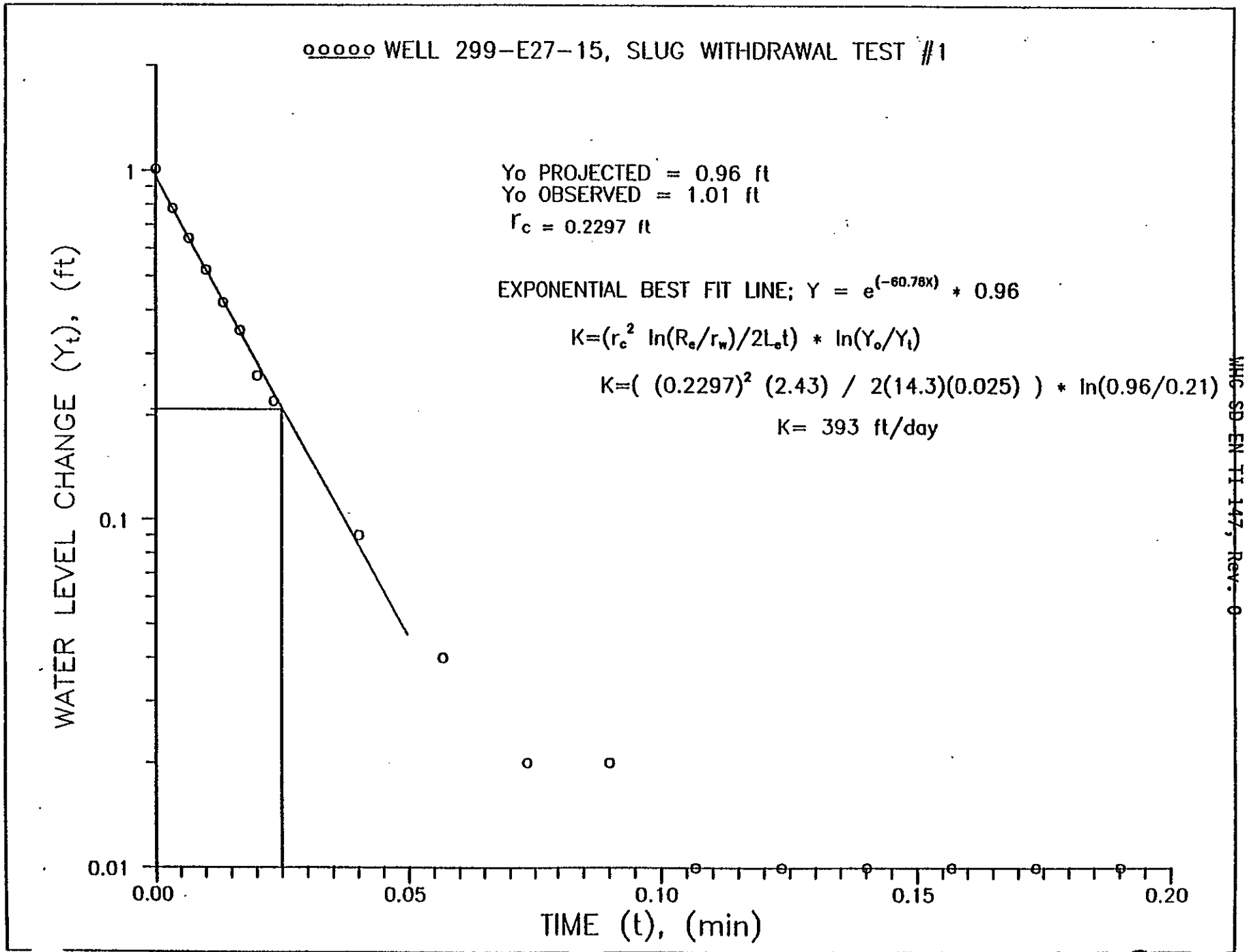
INPUT 1: Level (F)

Reference	0.00
Scale factor	9.99
Offset	-0.01

Elapsed Time, min	Value, ft
0.0000	- 1.06
0.0033	- 1.06
0.0066	- 1.06
0.0099	- 1.06
0.0133	- 1.06
0.0166	- 1.06
0.0200	- 1.06
0.0233	- 1.06
0.0266	- 1.06
0.0300	- 1.06
0.0333	- 1.07
0.0500	- 1.07
0.0666	- 1.07
0.0833	- 2.32
0.1000	- 1.19
0.1166	- 1.89
0.1333	- 1.37
0.1500	- 1.17
0.1666	- 1.10
0.1833	- 1.08
0.2000	- 1.08
0.2166	- 1.07
0.2333	- 1.07
0.2500	- 1.07
0.2666	- 1.07
0.2833	- 1.07
0.3000	- 1.07
0.3166	- 1.07
0.3333	- 1.07
0.4167	- 1.07
0.5000	- 1.07
0.5833	- 1.07
0.6667	- 1.07
0.7500	- 1.07
0.8333	- 1.07
0.9167	- 1.07
1.0000	- 1.07
1.0833	- 1.07
1.1667	- 1.07
1.2500	- 1.07
1.3333	- 1.06
1.4166	- 1.06
1.5000	- 1.06
1.5833	- 1.06
1.6667	- 1.06
1.7500	- 1.06
1.8333	- 1.06
1.9167	- 1.06
2.0000	- 1.06
2.5000	- 1.06
3.0000	- 1.06
3.5000	- 1.06
4.0000	- 1.06
4.5000	- 1.06
5.0000	- 1.06
5.5000	- 1.06
6.0000	- 1.06
6.5000	- 1.06
7.0000	- 1.06
7.5000	- 1.06
8.0000	- 1.06
8.5000	- 1.06
9.0000	- 1.06
9.5000	- 1.06
10.0000	- 1.06
12.0000	- 1.07

END


WATER LEVEL CHANGE (ft)
-0.00
-0.20
-0.40
-0.60
-0.80
-1.00
-1.20
-1.40
0.00
0.05
0.10
0.15
0.20
0.25
TIME (min)
ooooo WELL 299-E27-15, SLUG WITHDRAWAL TEST #1



WHC-SD-EN-TI-147, Rev. 0

WELL 299-E27-15, SLUG WITHDRAWAL TEST #1

THE BELOW HYDRAULIC CONDUCTIVITY VALUE WAS CALCULATED USING THE BOUWER AND RICE SLUG TEST METHOD.
SOURCE= "THE BOUWER AND RICE SLUG TEST-AN UPDATE" GROUND WATER, VOL 27, NO. 3, MAY-JUNE 1989.

RADIUS OF CASING USED IN CALCULATIONS HAS BEEN CORRECTED FOR THE THICKNESS OF GRAVEL OR SAND PACK DUE TO WATER LEVEL CHANGES IN THE SCREEN OR OPEN INTERVAL OF WELL.

Rc (ft)	Rw (ft)	Le (ft)	Lw (ft)	H (ft)
.2297	.3333	14.3000	14.3000	50.0000

Le/Rw = 42.9000000
A= 2.9202500
B= 4.656601E-001
C= 2.5309510
SANDPACK POROSITY= 3.000000E-001
t (min)= 2.500000E-002
1/t= 40.0000000
Yo= (ft) 9.600000E-001
Yt= (ft) 2.100000E-001
1/t ln(Yo/Yt)= 60.7930300
ln[(H-Lw)/Rw]= 4.6737630
ln(Re/Rw)= 2.4304660

K (ft/day) = 392.6369000

T OF THE SATURATED SCREEN INTERVAL
(ft2/day)= 5614.7080000

APPENDIX H

TEST DATA AND ANALYSIS FOR WELL 299-E33-33

9930033.1505

APPENDIX H

TEST DATA AND ANALYSIS FOR WELL 299-E33-33

This appendix contains the as-built diagram for the well construction, Slug Test Record Form, Aquifer Test Data Sheets, Equipment Record Forms, Electronic Data Control Forms, and accompanying data logs and plots for well 299-E33-33.

9330018.1595

Battelle
Pacific Northwest Laboratories

AS-BUILT DIAGRAM

Well Number 299-E33-33 Geologist GOODWIN JENSEN, BRANDON BERGEN Page 1 of 2

Reviewed by W.L. McLellan Date 12-19-89

Construction Data		Depth in Feet	Geologic/Hydrologic Data	
Description	Diagram		Diagram Litho.	Lithologic Description
		5		MUDDY SANDY GRAVEL
154' 1/4" OF 10" CARBON STEEL CASING (REMOVED)		10		SANDY GRAVEL
CEMENT GROUT		15		" "
		20		" "
253'7 3/4" OF 8" CARBON STEEL CASING (REMOVED)		25		" "
		30		" "
		35		GRAVELLY SAND
227.77' 4" DIA. STAINLESS STEEL CASING		40		SAND
		45		"
		50		"
		55		"
		60		"
		65		SLIGHTLY GRAVELLY SAND
		70		" " "
		75		SAND
		80		SLIGHTLY GRAVELLY SAND
		85		GRAVELLY SAND
		90		SLIGHTLY GRAVELLY SAND
		95		SLIGHTLY MUDDY SAND
		100		SAND
		105		"
FACTORY INSTALLED CENTRALIZERS		110		"
		115		SLIGHTLY MUDDY SAND
		120		SAND
		125		"
		130		"

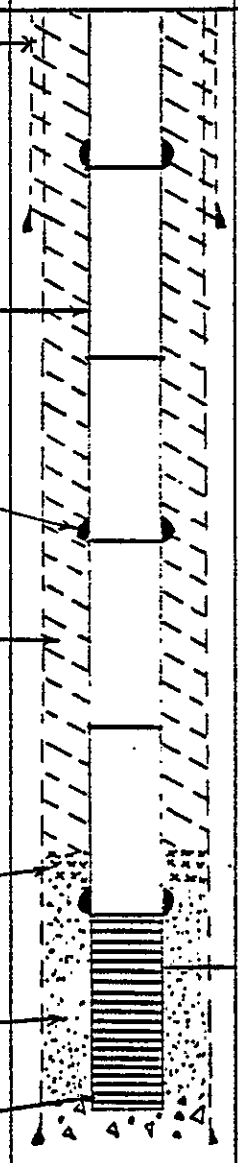
8912080259

Battelle
Pacific Northwest Laboratories

AS-BUILT DIAGRAM

Well Number 299-E33-33 Geologist GOODWIN JENSEN BRANDSBERGER Page 2 of 2

Reviewed by D.L. McGlam Date 12-19-89

Construction Data		Depth in Feet	Geologic/Hydrologic Data	
Description	Diagram		Diagram Litho.	Lithologic Description
154' 1½" OF 10" CARBON STEEL CASING WITH DRIVE SHOE (REMOVED)		135		SLIGHTLY GRAVELLY SAND
		140		" " "
		145		" " "
		150		SAND
227.77'		155		SLIGHTLY GRAVELLY SAND
4" DIA. STAINLESS STEEL CASING		160		157: MUD 3" THICK
		165		" " "
		170		SL. GRAVELLY MUDDY SAND
		175		SLIGHTLY MUDDY SAND
		180		" " "
FACTORY INSTALLED CENTRALIZERS		185		MUDDY SAND
		190		SL GRAVELLY MUDDY SAND
		195		" " " "
8-20 BENTONITE CRUMBLES		200		GRAVELLY MUDDY SAND
		205		SAND
		210		MUDDY SAND
		215		SAND
		220		MUDDY SANDY GRAVEL
¼" VOLCLAY PELLETS		225		" " "
		230		" " "
		235		" " "
20-40 COL. SILICA SAND		240		" " "
		245		" " "
21'-STAINLESS STEEL, 4" 10-SLOT CHANNEL PACK		250		" " "
		252'		HIT BASALT @ 252'

DOE/RL 96-17

Aquifer Test Data

Data for Well E33-33
Pumping Well ~~E33-33~~ DKW 9/2
Observation Wells N/A

Location 200 east, E33-33
Type of Aquifer Test slug injection/withdrawal
How Q Measured —
How W.L.'s Measured Tape - L300-14, datalogger/transducer S/N 259198
Rad Dist of From Pumping Well 2"
Meas. Point for W.L.'s Top of 6" casing
Elevation of Meas. Point
Depth of Pump/Airpipe
Pump On: date — time —
Pump Off: date — time —
Duration of Aquifer Test —

Time t = ____ at t' = 0					Water Level Data Static Water Level 235.45 below TOC					Discharge		Recorded By	Comments
Day	Clock Time	t	t'	t/t'	Reading	Conversions or Corrections	Water Level	s or s'		Reading	Q		
9/27	1044											Lee	8' 5/8" length slug
	1047				235.45								0.24 ft in diameter
	1056				235.45								
	11:22				transducer set at		16.19				1 ver ft		XD
					test 0 = drop slug								
	11:25				16.18								XD
	11:29				16.18	Reference level							XD
	11:35				slug dropped								
	11:46				-.01	slug fully	recovered						XD
	11:58				stopped test								
					test 1 = test 0					Reduced			dropped slug
					test 2 =								
	12:07				16.18	Reference							
					test 2 = pull slug out								
	12:50				16.17	Reference							XD
	12:53				pulled slug								
					Data Logger started #								IKB-701
	13:15				1 Bailer Volume Bailed =					Empty			- Sandy water
	13:17				2nd Bailer Volume Bailed =					Empty			
	13:26				2 Bailer Volumes								
↓					249.3	+2.5 steel tape							Depth to bottom
					= 251.8' below TOC is depth to bottom								

William A Cronin
9.27.89

Location 200 East, B Tank Farm Date of Test 9/27/89

Well Number 299-E33-33 Procedure Number PNL-MA-567 AT-6, Rev 0

Type of Test(s) Slug Injection / Withdrawal

Personnel Conducting Test Darrell Newcomer, Bill Cronin, Darrell Ludke (KEH)

WELL CONFIGURATION

Well Depth 248.8' below cement pad Borehole Diameter 8"

Well Casing Inside Diameter 4" Well Screen Inside Diameter 4"

Length of Screened Interval 17' (below water) Depth of Screen 227'-248'

Comments Slug test conducted in undeveloped well

SLUG INFORMATION

Slug Construction Materials Carbon steel

Length of Slug 8.05' Diameter of Slug 0.24'

Comments

Volume of Attachments (if applicable)

MEASUREMENT EQUIPMENT INFORMATION

	Make	Model	Serial Number
Electric Tape			
Steel Tape	Lufkin	Super Hi-Way Nubian	L300-14
Data logger	In Situ	SE1000 B	1KB-701
Transducer	Druck	PTX-161D	259198
Other			

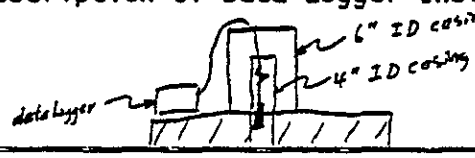
Darrell Newcomer 9/27/89

9330019.0615

Equipment Record Form for the Installation and Removal of Data Loggers and Pressure Transducers

Initial Check: ok		
Purpose of Installation: To monitor slug injection/withdrawal test responses		
Monitored Hydrologic Unit or Water Body: Uppermost Unconfined Aquifer (Hanford formation)		
Date/Time of Installation: 9/27/89 1100 hrs	Procedure Followed: PNL-MA-567 WL-4, Rev 0	
Data Logger Make/Model: In Situ / SE 1000 B		
Serial No.: 1KB-701	Number of Channels Used: 1	
Pressure Transducer Make/Model: Druck / PTX-161D	Full Scale Range: 10 psi	Well No.: 299-E33-33
	Serial No.: 259198	Depth: ~248.6 below cement pad
Pressure Transducer Make/Model:	Full Scale Range:	Well No.:
	Serial No.:	Depth:

Description of Data Logger Installation and Well Head Configuration:



Stickup of 6" casing is ~3 feet.

Comments:

Slug was positioned into place above the water before placing the transducer down the well

Equipment Installed By D.R. Newcomer, Bill Cronin

Date/Time of Equipment Removal: 9/27/89 1300 hrs.

Decontamination Procedure (if required):

Equipment Removed By Darrell R. Newcomer, Bill Cronin,

Darrell Newcomer 9/27/89

(5/18/89, Rev. 0)

ELECTRONIC DATA CONTROL FORM

DATE AND START TIME OF DATA ACQUISITION 9/27/89 11:35

DATE AND END TIME OF DATA ACQUISITION 9/27/89 11:55

WELL NUMBER E33-33

TYPE OF TEST OR DATA Slug

TYPE AND IDENTIFICATION NUMBER OF DATA LOGGER In Situ Hermit Serial # 1KB-701

TEST NUMBER 0

CHANNEL OR INPUT NUMBER 1

UNITS OF VALUES RECORDED Ft

NUMBER OF PAGES ATTACHED 2

COMMENTS: Test 0 = Submerging slug

DATA VALIDATION STATEMENT:

The attached data represent the data as originally recorded on the data logger. Any exceptions and reasons for such are indicated in the comments section.

William E Cronin, Hydrologist — Name, title

9/28/89 — Date

Well: 299-E33-33
Test Date: September 27, 1989
Start Time: 11:35

SE1000B
Environmental Logger
09/28 08:59

Unit# 00701 Test# 0

INPUT 1: Level (F)

Reference	0.00
Scale factor	9.98
Offset	- 0.01

Elapsed Time, min	Value, ft
0.0000	- 0.01
0.0033	- 0.01
0.0066	- 0.01
0.0099	- 0.01
0.0133	- 0.01
0.0166	- 0.01
0.0200	- 0.00
0.0233	0.97
0.0266	0.52
0.0300	1.25
0.0333	1.19
0.0500	0.49
0.0666	- 0.00
0.0833	- 0.01
0.1000	- 0.00
0.1166	- 0.00
0.1333	- 0.00
0.1500	- 0.00
0.1666	- 0.00
0.1833	- 0.00
0.2000	- 0.00
0.2166	- 0.00
0.2333	- 0.00
0.2500	- 0.00
0.2666	- 0.00
0.2833	- 0.00
0.3000	- 0.00
0.3166	- 0.00
0.3333	- 0.00
0.4167	- 0.00
0.5000	- 0.00
0.5833	- 0.01
0.6667	- 0.01
0.7500	- 0.01
0.8333	- 0.01
0.9167	- 0.01
1.0000	- 0.01
1.0833	- 0.01
1.1667	- 0.01
1.2500	- 0.01
1.3333	- 0.01
1.4166	- 0.01
1.5000	- 0.01
1.5833	- 0.01
1.6667	- 0.01
1.7500	- 0.01
1.8333	- 0.01
1.9167	- 0.01
2.0000	- 0.01
2.5000	- 0.01
3.0000	- 0.01
3.5000	- 0.01
4.0000	- 0.01
4.5000	- 0.01
5.0000	- 0.01
5.5000	- 0.01
6.0000	- 0.01
6.5000	- 0.01
7.0000	- 0.01
7.5000	- 0.01
8.0000	- 0.01
8.5000	- 0.01
9.0000	- 0.01
9.5000	- 0.01
10.0000	- 0.01
12.0000	- 0.01
14.0000	- 0.01
16.0000	- 0.01
18.0000	- 0.01
20.0000	- 0.02

END

9330818.0605

(5/18/89, Rev. 0)

ELECTRONIC DATA CONTROL FORM

DATE AND START TIME OF DATA ACQUISITION 9/27/89 12:10

DATE AND END TIME OF DATA ACQUISITION 9/27/89 12:20

WELL NUMBER E33-33

TYPE OF TEST OR DATA Slug

TYPE AND IDENTIFICATION NUMBER OF DATA LOGGER In Situ Hermit, serial # 1KB-701

TEST NUMBER 1

CHANNEL OR INPUT NUMBER 1

UNITS OF VALUES RECORDED ft

NUMBER OF PAGES ATTACHED 2

COMMENTS: We wanted to drop the slug again to make sure that the transducer + data logger were working properly. test 1 = submerging slug

DATA VALIDATION STATEMENT:

The attached data represent the data as originally recorded on the data logger. Any exceptions and reasons for such are indicated in the comments section.

William E Crain, Hydrologist — 9/28/89

Name, title — Date

9330018.1505

Well: 299-E33-33
Test Date: September 27, 1989
Start Time: 12:10

SE1000B
Environmental Logger
09/28 09:01

Unit# 00701 Test# 1

INPUT 1: Level (F)

Reference	0.00
Scale factor	9.98
Offset	- 0.01

Elapsed Time, min	Value, ft
0.0000	0.08
0.0033	0.05
0.0066	0.03
0.0099	0.01
0.0133	0.39
0.0166	0.28
0.0200	0.18
0.0233	0.39
0.0266	0.36
0.0300	0.46
0.0333	0.45
0.0500	0.58
0.0666	0.50
0.0833	0.25
0.1000	- 1.37
0.1166	- 0.07
0.1333	0.03
0.1500	0.00
0.1666	0.01
0.1833	0.00
0.2000	0.00
0.2166	0.00
0.2333	0.00
0.2500	0.00
0.2666	0.00
0.2833	0.00
0.3000	0.00
0.3166	0.00
0.3333	0.00
0.4167	0.00
0.5000	0.00
0.5833	0.00
0.6667	0.00
0.7500	0.00
0.8333	0.00
0.9167	0.00
1.0000	0.00
1.0833	0.00
1.1667	0.00
1.2500	0.00
1.3333	0.00
1.4166	0.00
1.5000	0.00
1.5833	0.00
1.6667	0.00
1.7500	0.00
1.8333	- 0.00
1.9167	0.00
2.0000	0.00
2.5000	0.00
3.0000	0.00
3.5000	- 0.00
4.0000	- 0.00
4.5000	- 0.00
5.0000	- 0.00
5.5000	- 0.00
6.0000	- 0.00
6.5000	- 0.00
7.0000	- 0.00
7.5000	- 0.00
8.0000	- 0.00
8.5000	- 0.00
9.0000	- 0.00
9.5000	- 0.00
10.0000	- 0.00

END

9830.1607

(5/18/89, Rev. 0)

ELECTRONIC DATA CONTROL FORM

DATE AND START TIME OF DATA ACQUISITION 9/27/87 12:53

DATE AND END TIME OF DATA ACQUISITION 9/27/89 13:03

WELL NUMBER 1E 33-33

TYPE OF TEST OR DATA Slug

TYPE AND IDENTIFICATION NUMBER OF DATA LOGGER In Situ Hermit, serial # 1KB-701

TEST NUMBER 2

CHANNEL OR INPUT NUMBER 1

UNITS OF VALUES RECORDED ft

NUMBER OF PAGES ATTACHED 2

COMMENTS: Test 2 = Lifting slug.

DATA VALIDATION STATEMENT:

The attached data represent the data as originally recorded on the data logger. Any exceptions and reasons for such are indicated in the comments section.

William E Cronin, Hydrologist — 9/28/89

Name, title — Date

Well: 299-E33-33
Test Date: September 27, 1989
Start Time: 12:53

SE1000B
Environmental Logger
09/28 09:04

Unit# 00701 Test# 2

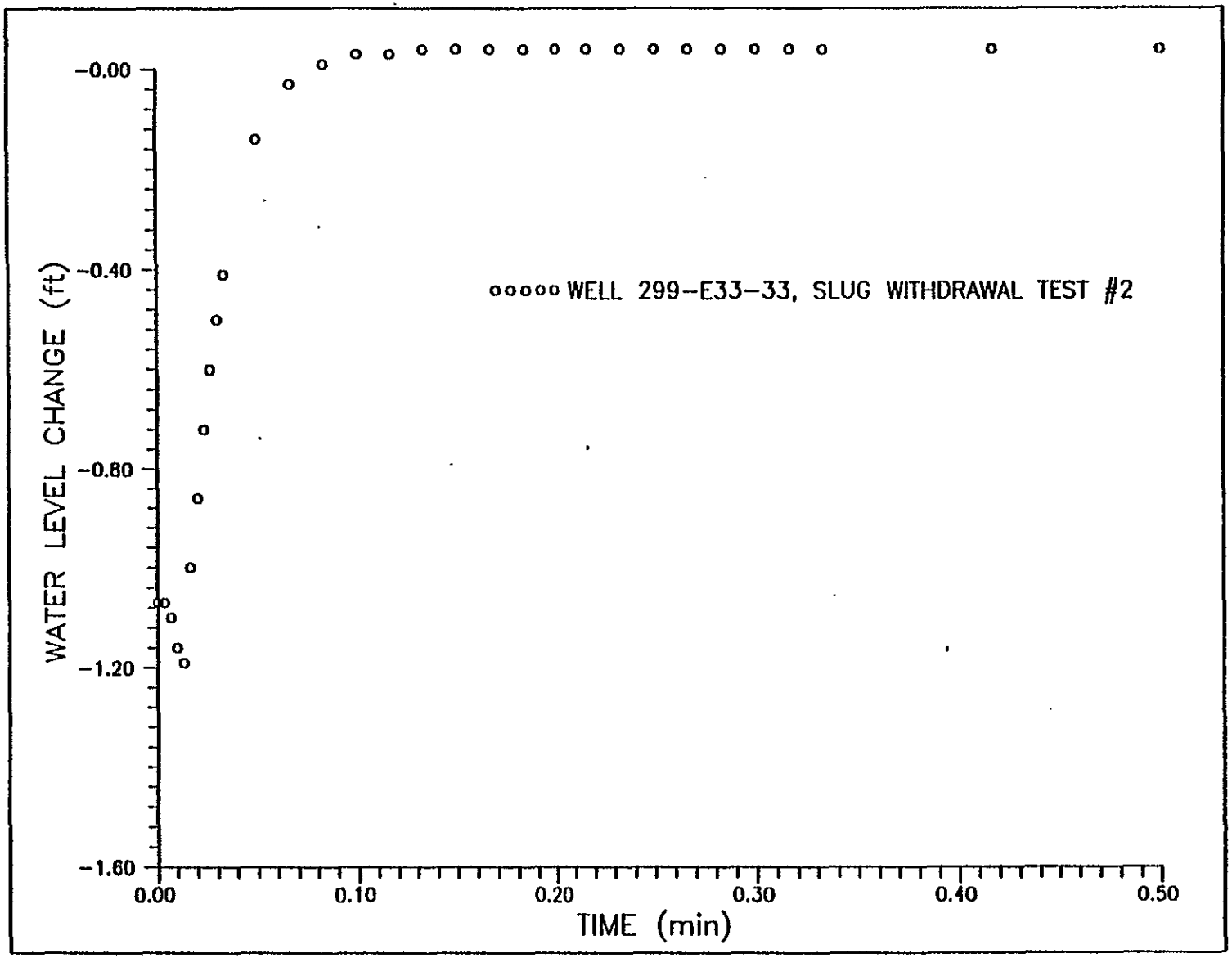
INPUT 1: Level (F)

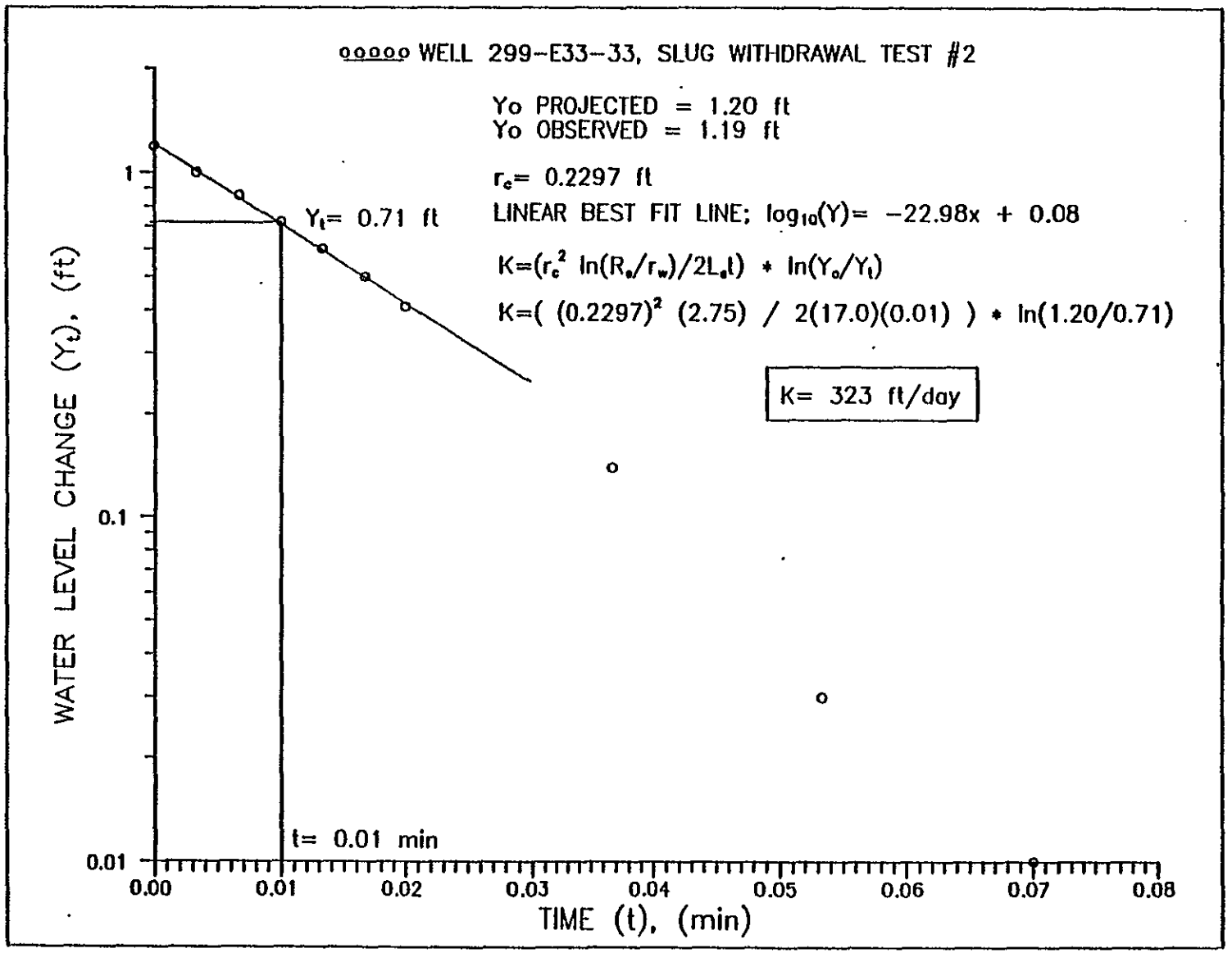
Reference 0.00
Scale factor 9.98
Offset - 0.01

Elapsed Time, min	Value, ft
0.0000	- 1.07
0.0033	- 1.07
0.0066	- 1.10
0.0099	- 1.16
0.0133	- 1.19
0.0166	- 1.00
0.0200	- 0.86
0.0233	- 0.72
0.0266	- 0.60
0.0300	- 0.50
0.0333	- 0.41
0.0500	- 0.14
0.0666	- 0.03
0.0833	0.01
0.1000	0.03
0.1166	0.03
0.1333	0.04
0.1500	0.04
0.1666	0.04
0.1833	0.04
0.2000	0.04
0.2166	0.04
0.2333	0.04
0.2500	0.04
0.2666	0.04
0.2833	0.04
0.3000	0.04
0.3166	0.04
0.3333	0.04
0.4167	0.04
0.5000	0.04
0.5833	0.03
0.6667	0.03
0.7500	0.03
0.8333	0.03
0.9167	0.03
1.0000	0.03
1.0833	0.03
1.1667	0.03
1.2500	0.03
1.3333	0.03
1.4166	0.03
1.5000	0.03
1.5833	0.03
1.6667	0.03
1.7500	0.02
1.8333	0.02
1.9167	0.02
2.0000	0.02
2.5000	0.02
3.0000	0.02
3.5000	0.02
4.0000	0.02
4.5000	0.02
5.0000	0.02
5.5000	0.01
6.0000	0.01
6.5000	0.01
7.0000	0.01
7.5000	0.01
8.0000	0.01
8.5000	0.01
9.0000	0.01
9.5000	0.01
10.0000	0.01

END

B-3508 1609


WELL 299-E33-33, SLUG WITHDRAWAL TEST #2
WATER LEVEL CHANGE (ft)
-0.00
-0.40
-0.80
-1.20
-1.60
0.00
0.10
0.20
0.30
0.40
0.50
TIME (min)


WELL 299-E33-33, SLUG WITHDRAWAL TEST #2
Yo PROJECTED = 1.20 ft
Yo OBSERVED = 1.19 ft
r_c= 0.2297 ft
LINEAR BEST FIT LINE; $\log_{10}(Y)$= −22.98x + 0.08
$K=(r_c^2 \ln(R_e/r_w)/2L_e t) * \ln(Y_o/Y_t)$
$K=((0.2297)^2 (2.75) / 2(17.0)(0.01)) * \ln(1.20/0.71)$
K= 323 ft/day
Y_t= 0.71 ft
t= 0.01 min
WATER LEVEL CHANGE (Y_t), (ft)
1
0.1
0.01
0.00
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
TIME (t), (min)

WELL 299-E33-33, SLUG WITHDRAWAL TEST #2

****

THE BELOW HYDRAULIC CONDUCTIVITY VALUE WAS CALCULATED
USING THE BOUWER AND RICE SLUG TEST METHOD.
SOURCE= "THE BOUWER AND RICE SLUG TEST-AN UPDATE"
GROUND WATER, VOL 27, NO. 3, MAY-JUNE 1989.

****

****

RADIUS OF CASING USED IN CALCULATIONS HAS BEEN
CORRECTED FOR THE THICKNESS OF GRAVEL OR SAND
PACK DUE TO WATER LEVEL CHANGES IN THE SCREEN OR
OPEN INTERVAL OF WELL.

****

Rc (ft)	Rw (ft)	Le (ft)	Lw (ft)	H (ft)
.2297	.3333	17.0000	17.0000	20.0000

****

Le/Rw = 51.0000000
A= 3.1242380
B= 5.126348E-001
C= 2.7365890
SANDPACK POROSITY= 3.000000E-001
t (min)= 1.000000E-002
1/t= 100.0000000
Yo= (ft) 1.2000000
Yt= (ft) 7.100000E-001
1/t ln(Yo/Yt)= 52.4811900
ln[(H-Lw)/Rw]= 2.1972250
ln(Re/Rw)= 2.7539590

****

K (ft/day) = 323.0699000

****

T OF THE SATURATED SCREEN INTERVAL
(ft2/day)= 5492.1880000

****

9350015.0615

APPENDIX I

TEST DATA AND ANALYSIS FOR WELL 299-W10-15

9130010.1543

APPENDIX I

TEST DATA AND ANALYSIS FOR WELL 299-W10-15

This appendix contains the as-built diagram for the well construction, Slug Test Record Form, Aquifer Test Data Sheets, Equipment Record Forms, Electronic Data Control Forms, and accompanying data logs and plots for well 299-W10-15.

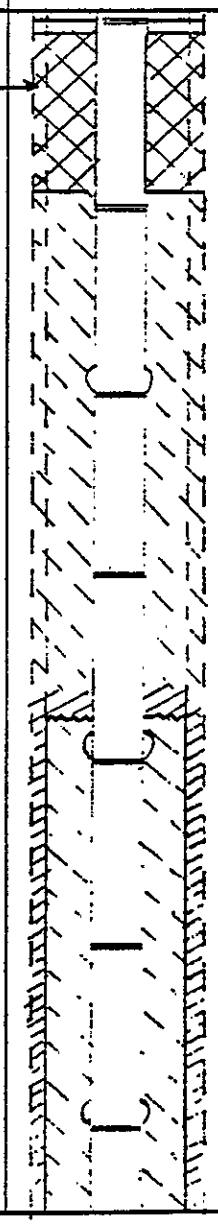
9330.016

Battelle
Pacific Northwest Laboratories

AS-BUILT DIAGRAM

Well Number 299-W10-15 Geologist BJORNSTAD, GILMORE, TEEL, AIRHART, GOODWIN, ETC. Page 1 of 2

Reviewed by V.G. McLehan Date 12-7-89

Construction Data		Depth in Feet	Geologic/Hydrologic Data	
Description	Diagram		Diagram Litho.	Lithologic Description
10" temporary casing - steel casing to 140'		5		Muddy sand DB drilling
		10		
		15		
		20		Sandy gravel
		25		
		30		Sand w/mud layers
		35		Sandy gravel
		40		Gravel
		45		Muddy sandy gravel
		50		
		55		Sandy gravel
		60		
		65		
		70		Gravelly sand
		75		Silty fn sand, laminated
		80		Muddy sand, calcareous dark brown
		85		
		90		
		95		96' switch to HT
		100		Caliche - calcareous cemented muddy sand
		105		
		110		
		115		
		120		
		125		

A-1800-186 (3/87)

5101250135

Battelle
Pacific Northwest Laboratories

AS-BUILT DIAGRAM

Well Number 299-W10-15 Geologist BJORNSTAD, GILMORE, TEEL, AIRHART, GOODWIN, ETC. Page 2 of 2

Reviewed by V.L. McGhan Date 12-7-89

Construction Data		Depth in Feet	Geologic/Hydrologic Data	
Description	Diagram		Diagram Litho.	Lithologic Description
		130		Caliche
				▲ gravels @ 152'
8" ± temporary carbon-steel casing to 222'				Muddy
		150		Sandy
				Gravel
203.25' of type 304 4" stainless steel casing		175		Gravelly Sand
				Sandy Gravel
		200		
21' of 10 slot continuous wrap stainless steel channel pack screen		220		
				Drill Depth = 222.34'
16-20 Mesh Col silica Sand				Completion Depth = 221.05'
Valclay Pellets				
8-20 bentonite Crumbles				
Valclay Pure Gold Slurry				
Cement				

A-1800-188 (3/87)

Aquifer Test Data

WHC-SD-EN-TI-147, Rev. 0

Data for Well 299-W10-15
Pumping Well –
Observation Wells –

Location 200 West, T Tank Farm
Type of Aquifer Test Slug Test
How Q Measured –
How W.L.'s Measured Transducer, Steel tape #L500-03
Rad/Dist of From Pumping Well 2"
Meas. Point for W.L.'s Top of 10" casing
Elevation of Meas. Point
Top of 10" casing is 6' 8" above land surface

Depth of Pump/Airpipe –
Pump On: date – time
Pump Off: date – time
Duration of Aquifer Test –

Time (DRN) t = ____ at t' = 0					Water Level Data Static Water Level 212.71' below ToC					Discharge		Recorded By	Comments
Day	Clock Time	t	t'	t/t'	Reading	Conversions or Corrections	Water Level	s or s		Reading	Q		
11/3	1105				212.71							DRN	
	1110				D/B = 226.2 + 2.47 = 228.67'								
	1130				Set slug and transducer in well								
	1135				15.94								Transducer reading
						Set slug below water and allow water level to stabilize							
	1141				15.99	Set Ref=0 Test #1						DRN	
	1145					Pull Slug (at log 1 cycle)							
	1158					Stop datalogger							Dump data to disk
													file: W10-15-2.SLG
	1234				16.00	Set Ref=0 Test #3							
	1237					Pull Slug (after log 1 cycle)							
	1248					Stop datalogger							Dump data to disk
													file: W10-15-3.SLG

Darrell Newcomer 11/3/89

8905250127

Location 200 West, T Farm Date of Test 11/3/89

Well Number 299-W10-15 Procedure Number PNL-MA-567 AT-6, Rev. 0

Type of Test(s) Slug Test

Personnel Conducting Test D. R. Newcomer, Darrell Ludke (KEH)

WELL CONFIGURATION

Well Depth ~222' b.l.s. Borehole Diameter 8"

Well Casing Inside Diameter 4" Well Screen Inside Diameter 4"

Length of Screened Interval ~15.8' below water Depth of Screen 200.8' to 221.8' b.l.s.

Comments Well is undeveloped

SLUG INFORMATION

Slug Construction Materials Carbon Steel

Length of Slug 6.0' Diameter of Slug 2¼"

Comments

Volume of Attachments (if applicable)

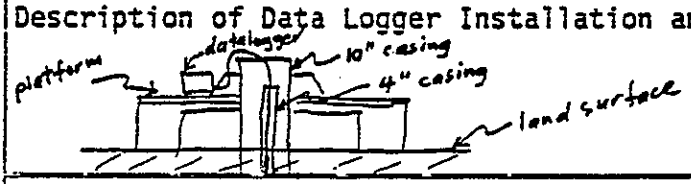
MEASUREMENT EQUIPMENT INFORMATION

	Make	Model	Serial Number
Electric Tape			
Steel Tape	Lufkin	Super Hi-way Nubian	L586-03
Data logger	In Situ	Hermit	1KB-700
Transducer	Druck	PTX-161D	259198
Other			

Equipment Record Form for the Installation and Removal of Data Loggers and Pressure Transducers

Initial Check: OK		
Purpose of Installation: To monitor water levels during the slug test		
Monitored Hydrologic Unit or Water Body: Saturated screen interval within the upper part of the aquifer		
Date/Time of Installation: 11/3/89 1130 hrs.	Procedure Followed: PNL-MA-567 WL-4, Rev 0	
Data Logger Make/Model: In Situ / Hermit SE1000B		
Serial No.: 1KB-700	Number of Channels Used: 1	
Pressure Transducer Make/Model: Druck / PTX-161D	Full Scale Range: 10 psi	Well No.: 299-W10-15
	Serial No.: 259198	Depth: ~222' b.l.s.
Pressure Transducer Make/Model:	Full Scale Range:	Well No.:
	Serial No.:	Depth:

Description of Data Logger Installation and Well Head Configuration:



10" casing is 6' 8" above land surface

Comments: Well has not been completed in the upper 75 ft. The 10" casing is not completely pulled out.

The slug was placed a few feet above static water level before the transducer was lowered to the bottom of the well. The slug was then lowered below static and water level was allowed to stabilize.

Equipment Installed By D. R. Newcomer	
Date/Time of Equipment Removal: 11/3/89 1300 hrs.	
Decontamination Procedure (if required):	
Equipment Removed By D.R. Newcomer	

(5/18/89, Rev. 0)

ELECTRONIC DATA CONTROL FORM

DATE AND START TIME OF DATA ACQUISITION 11/3/89 1145 hrs.

DATE AND END TIME OF DATA ACQUISITION 11/3/89 1157 hrs.

WELL NUMBER 299-W10-15

TYPE OF TEST OR DATA Slug Test

TYPE AND IDENTIFICATION NUMBER OF DATA LOGGER In Situ Hermit SE1000B S/N 1KB-700

TEST NUMBER 2

CHANNEL OR INPUT NUMBER 1

UNITS OF VALUES RECORDED ft

NUMBER OF PAGES ATTACHED 2

COMMENTS:
Test #2 = Withdrawal

DATA VALIDATION STATEMENT:

The attached data represent the data as originally recorded on the data logger. Any exceptions and reasons for such are indicated in the comments section.

Darrell Newcomer, Scientist
Name, title

11/3/89
Date

9913010.1697

Well: 299-W10-15
Test Date: November 3, 1989
Start Time: 11:45

SE1000B
Environmental Logger
11/03 12:01

Unit# 00700 Test# 2

INPUT 1: Level (F)

Reference	0.00
Scale factor	9.99
Offset	0.01

Elapsed Time, min	Value, ft
0.0000	0.00
0.0033	0.00
0.0066	- 7.52
0.0099	0.15
0.0133	- 2.34
0.0166	- 0.89
0.0200	- 0.82
0.0233	- 0.83
0.0266	- 2.28
0.0300	- 1.97
0.0333	- 1.86
0.0500	- 1.68
0.0666	- 1.55
0.0833	- 1.43
0.1000	- 1.30
0.1166	- 1.19
0.1333	- 1.08
0.1500	- 0.99
0.1666	- 0.90
0.1833	- 0.82
0.2000	- 0.75
0.2166	- 0.69
0.2333	- 0.63
0.2500	- 0.57
0.2666	- 0.52
0.2833	- 0.48
0.3000	- 0.44
0.3166	- 0.41
0.3333	- 0.37
0.4167	- 0.24
0.5000	- 0.16
0.5833	- 0.11
0.6667	- 0.07
0.7500	- 0.04
0.8333	- 0.02
0.9167	- 0.01
1.0000	- 0.00
1.0833	0.00
1.1667	0.00
1.2500	0.01
1.3333	0.01
1.4166	0.01
1.5000	0.02
1.5833	0.03
1.6667	0.03
1.7500	0.03
1.8333	0.03
1.9167	0.04
2.0000	0.04
2.5000	0.05
3.0000	0.05
3.5000	0.05
4.0000	0.05
4.5000	0.05
5.0000	0.05
5.5000	0.05
6.0000	0.05
6.5000	0.05
7.0000	0.05
7.5000	0.05
8.0000	0.05
8.5000	0.05
9.0000	0.05
9.5000	0.05
10.0000	0.05
12.0000	0.05

END

9130010.152

(5/18/89, Rev. 0)

ELECTRONIC DATA CONTROL FORM

DATE AND START TIME OF DATA ACQUISITION 11/3/89 1237 hrs.

DATE AND END TIME OF DATA ACQUISITION 11/3/89 1247 hrs.

WELL NUMBER 299-W10-15

TYPE OF TEST OR DATA Slug Test

TYPE AND IDENTIFICATION NUMBER OF DATA LOGGER In Situ Hermit SE1000 B S/N 1KB-700

TEST NUMBER 3

CHANNEL OR INPUT NUMBER 1

UNITS OF VALUES RECORDED ft.

NUMBER OF PAGES ATTACHED 2

COMMENTS:
Test #3 = withdrawal Test

DATA VALIDATION STATEMENT:

The attached data represent the data as originally recorded on the data logger. Any exceptions and reasons for such are indicated in the comments section.

Darrell Newcomer, Scientist — 11/3/89

Name, title — Date

9313018.1675

Well: 299-W10-15
Test Date: November 3, 1989
Start Time: 12:37

SE1000B
Environmental Logger
11/03 12:52

Unit# 00700 Test# 3

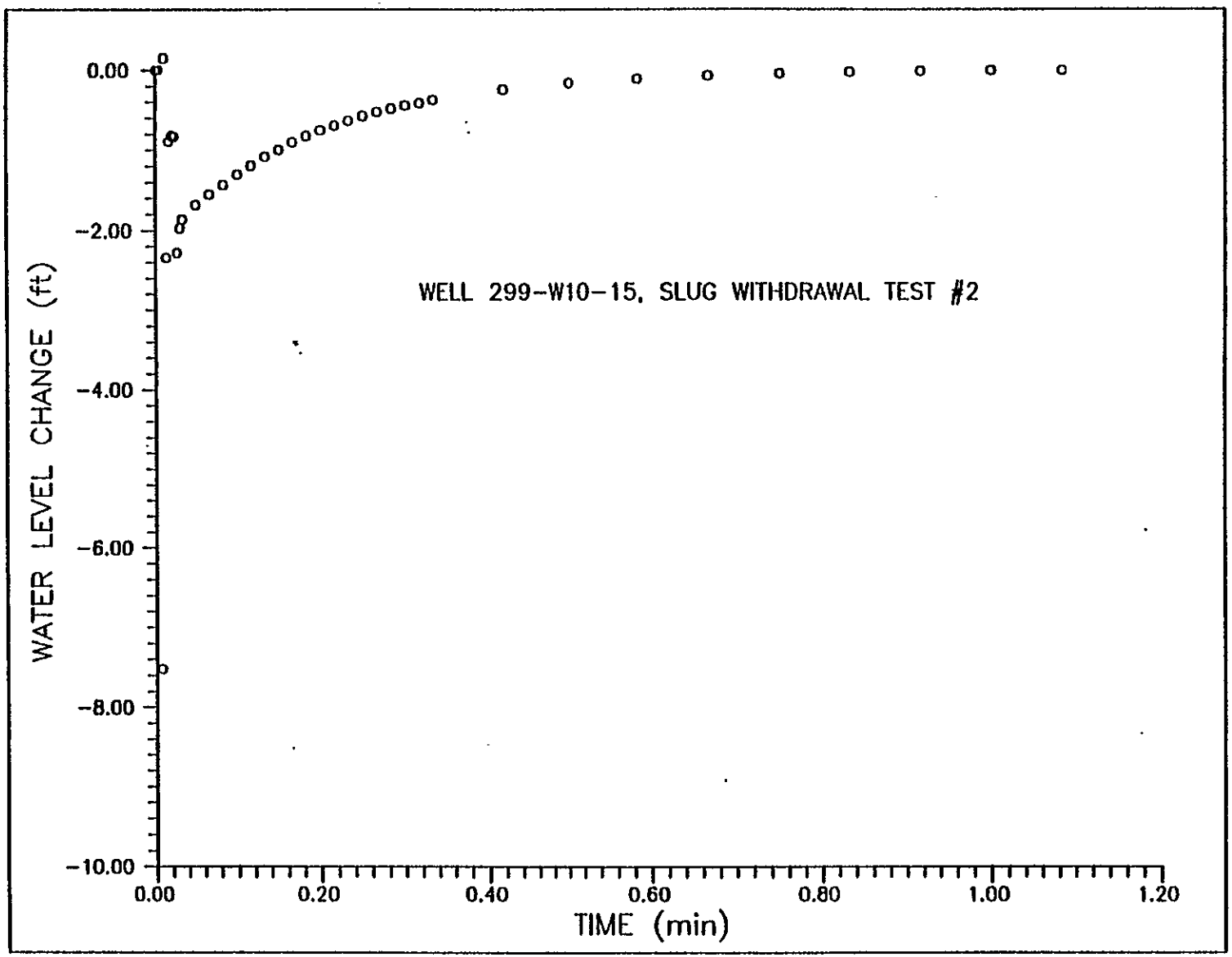
INPUT 1: Level (F)

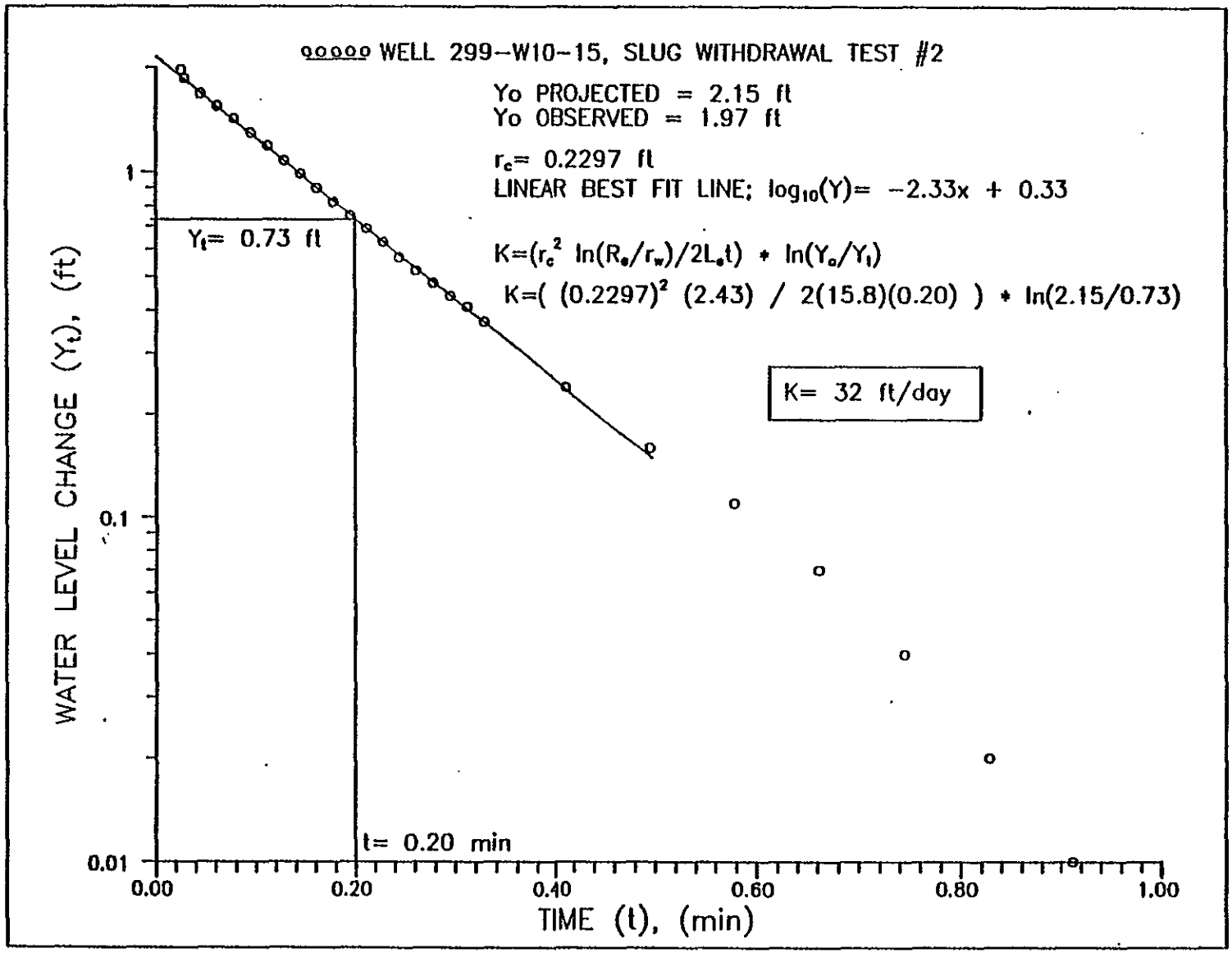
Reference	0.00
Scale factor	9.99
Offset	0.01

Elapsed Time, min	Value, ft
0.0000	0.00
0.0033	0.00
0.0066	0.00
0.0099	- 15.19
0.0133	- 0.43
0.0166	- 1.64
0.0200	- 1.51
0.0233	- 0.32
0.0266	- 0.76
0.0300	- 1.87
0.0333	- 1.93
0.0500	- 1.67
0.0666	- 1.51
0.0833	- 1.37
0.1000	- 1.24
0.1166	- 1.14
0.1333	- 1.04
0.1500	- 0.93
0.1666	- 0.85
0.1833	- 0.77
0.2000	- 0.70
0.2166	- 0.64
0.2333	- 0.58
0.2500	- 0.52
0.2666	- 0.47
0.2833	- 0.43
0.3000	- 0.39
0.3166	- 0.35
0.3333	- 0.32
0.4167	- 0.20
0.5000	- 0.13
0.5833	- 0.08
0.6667	- 0.05
0.7500	- 0.02
0.8333	- 0.01
0.9167	0.00
1.0000	0.00
1.0833	0.01
1.1667	0.02
1.2500	0.02
1.3333	0.03
1.4166	0.03
1.5000	0.03
1.5833	0.04
1.6667	0.04
1.7500	0.04
1.8333	0.04
1.9167	0.05
2.0000	0.05
2.5000	0.05
3.0000	0.05
3.5000	0.05
4.0000	0.05
4.5000	0.05
5.0000	0.05
5.5000	0.05
6.0000	0.05
6.5000	0.05
7.0000	0.05
7.5000	0.05
8.0000	0.05
8.5000	0.05
9.0000	0.05
9.5000	0.05
10.0000	0.05

END

9343018.1623


WELL 299-W10-15, SLUG WITHDRAWAL TEST #2
WATER LEVEL CHANGE (ft)
0.00
-2.00
-4.00
-6.00
-8.00
-10.00
0.00
0.20
0.40
0.60
0.80
1.00
1.20
TIME (min)


WELL 299-W10-15, SLUG WITHDRAWAL TEST #2
Yo PROJECTED = 2.15 ft
Yo OBSERVED = 1.97 ft
r_c= 0.2297 ft
LINEAR BEST FIT LINE; $\log_{10}(Y)$= -2.33x + 0.33
$K=(r_c^2 \ln(R_e/r_w)/2L_e t) + \ln(Y_o/Y_t)$
$K=((0.2297)^2 (2.43) / 2(15.8)(0.20)) + \ln(2.15/0.73)$
K= 32 ft/day
Y_t= 0.73 ft
t= 0.20 min
WATER LEVEL CHANGE (Y_t), (ft)
TIME (t), (min)
1
0.1
0.01
0.00
0.20
0.40
0.60
0.80
1.00

WELL 299-W10-15, SLUG WITHDRAWAL TEST #2

****

THE BELOW HYDRAULIC CONDUCTIVITY VALUE WAS CALCULATED
USING THE BOUWER AND RICE SLUG TEST METHOD.
SOURCE= "THE BOUWER AND RICE SLUG TEST-AN UPDATE"
GROUND WATER, VOL 27, NO. 3, MAY-JUNE 1989.

****

****

RADIUS OF CASING USED IN CALCULATIONS HAS BEEN
CORRECTED FOR THE THICKNESS OF GRAVEL OR SAND
PACK DUE TO WATER LEVEL CHANGES IN THE SCREEN OR
OPEN INTERVAL OF WELL.

****

Rc (ft)	Rw (ft)	Le (ft)	Lw (ft)	H (ft)
.2297	.3333	15.8000	15.8000	275.0000

****

Le/Rw = 47.4000000
A= 3.0284980
B= 4.921462E-001
C= 2.6137240
SANDPACK POROSITY= 3.000000E-001
t (min)= 2.000000E-001
1/t= 5.0000000
Yo= (ft) 2.1500000
Yt= (ft) 7.300000E-001
1/t ln(Yo/Yt)= 5.4008930
ln[(H-Lw)/Rw]= 6.0000000
ln(Re/Rw)= 2.4315210

****

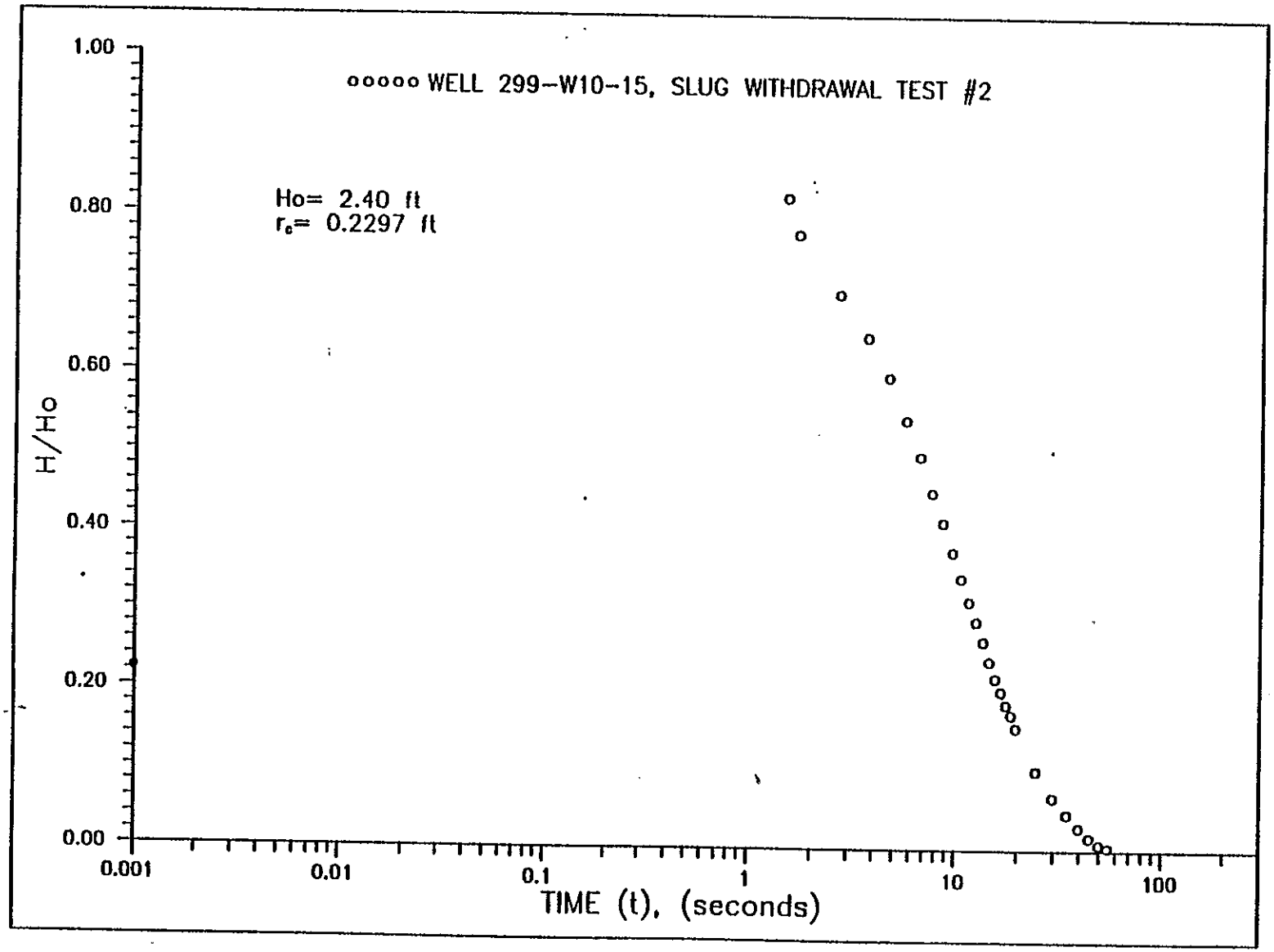
K (ft/day) = 31.5842200

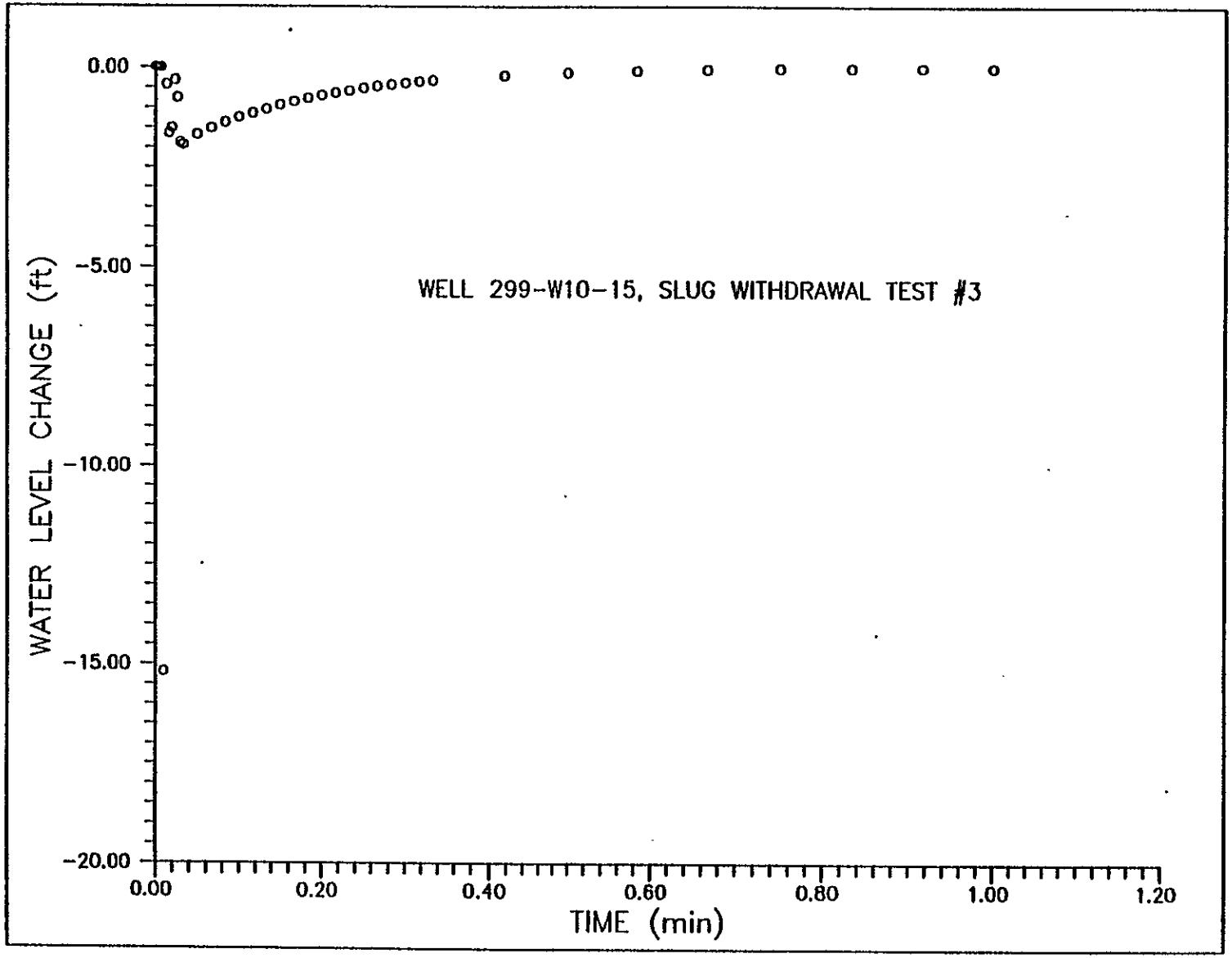
****

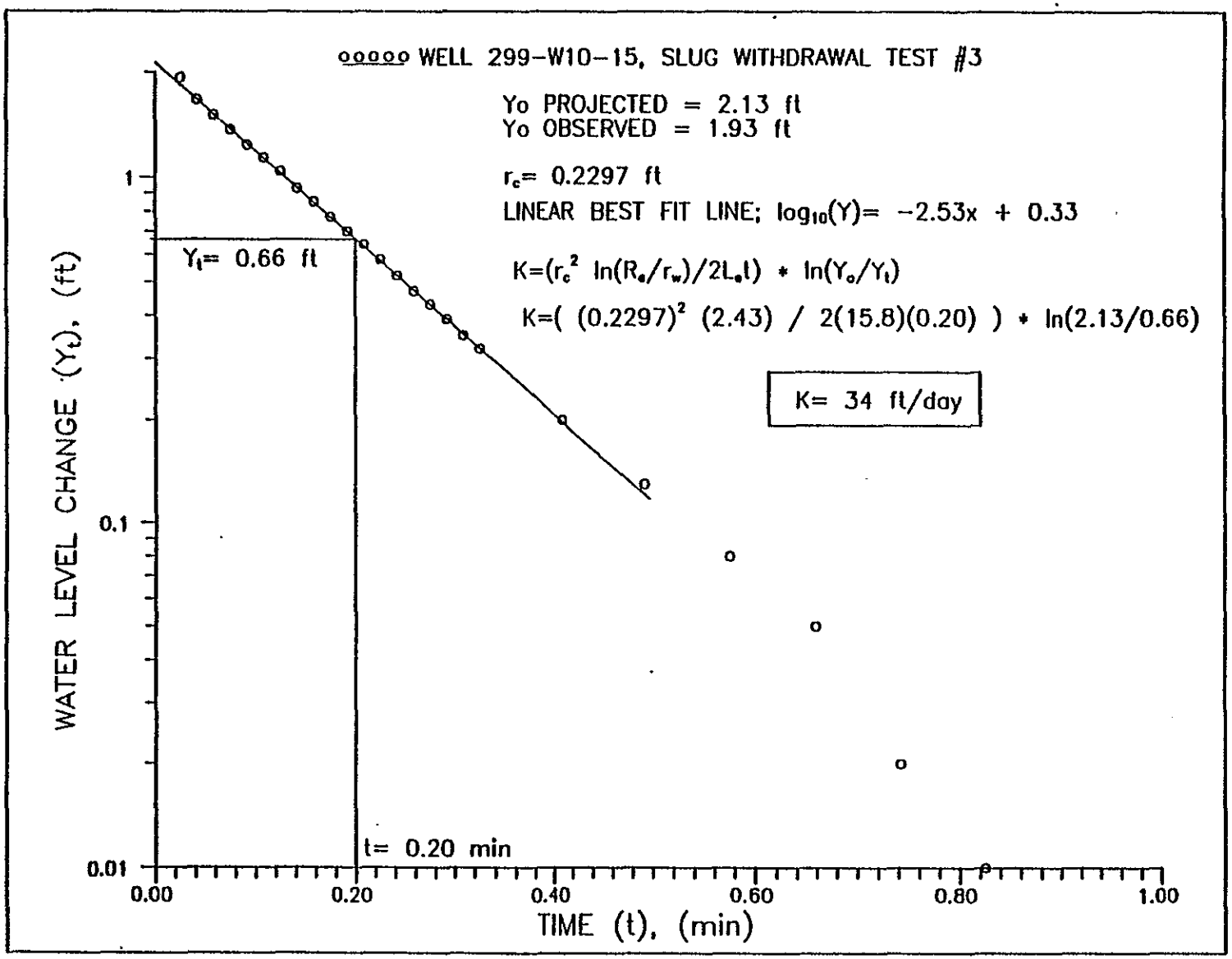
T OF THE SATURATED SCREEN INTERVAL
(ft2/day)= 499.0307000

****

9330.1627


ooooo WELL 299-W10-15, SLUG WITHDRAWAL TEST #2
Ho= 2.40 ft
r_c= 0.2297 ft
H/Ho
1.00
0.80
0.60
0.40
0.20
0.00
0.001
0.01
0.1
1
10
100
TIME (t), (seconds)


WELL 299-W10-15, SLUG WITHDRAWAL TEST #3
WATER LEVEL CHANGE (ft)
0.00
-5.00
-10.00
-15.00
-20.00
0.00
0.20
0.40
0.60
0.80
1.00
1.20
TIME (min)


WELL 299-W10-15, SLUG WITHDRAWAL TEST #3
Yo PROJECTED = 2.13 ft
Yo OBSERVED = 1.93 ft
r_c= 0.2297 ft
LINEAR BEST FIT LINE; $\log_{10}(Y)$= −2.53x + 0.33
$K=(r_c^2 \ln(R_e/r_w)/2L_e t) * \ln(Y_o/Y_t)$
$K=((0.2297)^2 (2.43) / 2(15.8)(0.20)) * \ln(2.13/0.66)$
K= 34 ft/day
Y_t= 0.66 ft
t= 0.20 min
WATER LEVEL CHANGE (Y_t), (ft)
TIME (t), (min)
1
0.1
0.01
0.00
0.20
0.40
0.60
0.80
1.00

WELL 299-W10-15, SLUG WITHDRAWAL TEST #3

****

THE BELOW HYDRAULIC CONDUCTIVITY VALUE WAS CALCULATED
USING THE BOUWER AND RICE SLUG TEST METHOD.
SOURCE= "THE BOUWER AND RICE SLUG TEST-AN UPDATE"
GROUND WATER, VOL 27, NO. 3, MAY-JUNE 1989.

****

****

RADIUS OF CASING USED IN CALCULATIONS HAS BEEN
CORRECTED FOR THE THICKNESS OF GRAVEL OR SAND
PACK DUE TO WATER LEVEL CHANGES IN THE SCREEN OR
OPEN INTERVAL OF WELL.

****

Rc (ft)	Rw (ft)	Le (ft)	Lw (ft)	H (ft)
.2297	.3333	15.8000	15.8000	275.0000

****

Le/Rw = 47.4000000
A= 3.0284980
B= 4.921462E-001
C= 2.6137240
SANDPACK POROSITY= 3.000000E-001
t (min)= 2.000000E-001
1/t= 5.0000000
Yo= (ft) 2.1300000
Yt= (ft) 6.600000E-001
1/t ln(Yo/Yt)= 5.8581870
ln[(H-Lw)/Rw]= 6.0000000
ln(Re/Rw)= 2.4315210

****

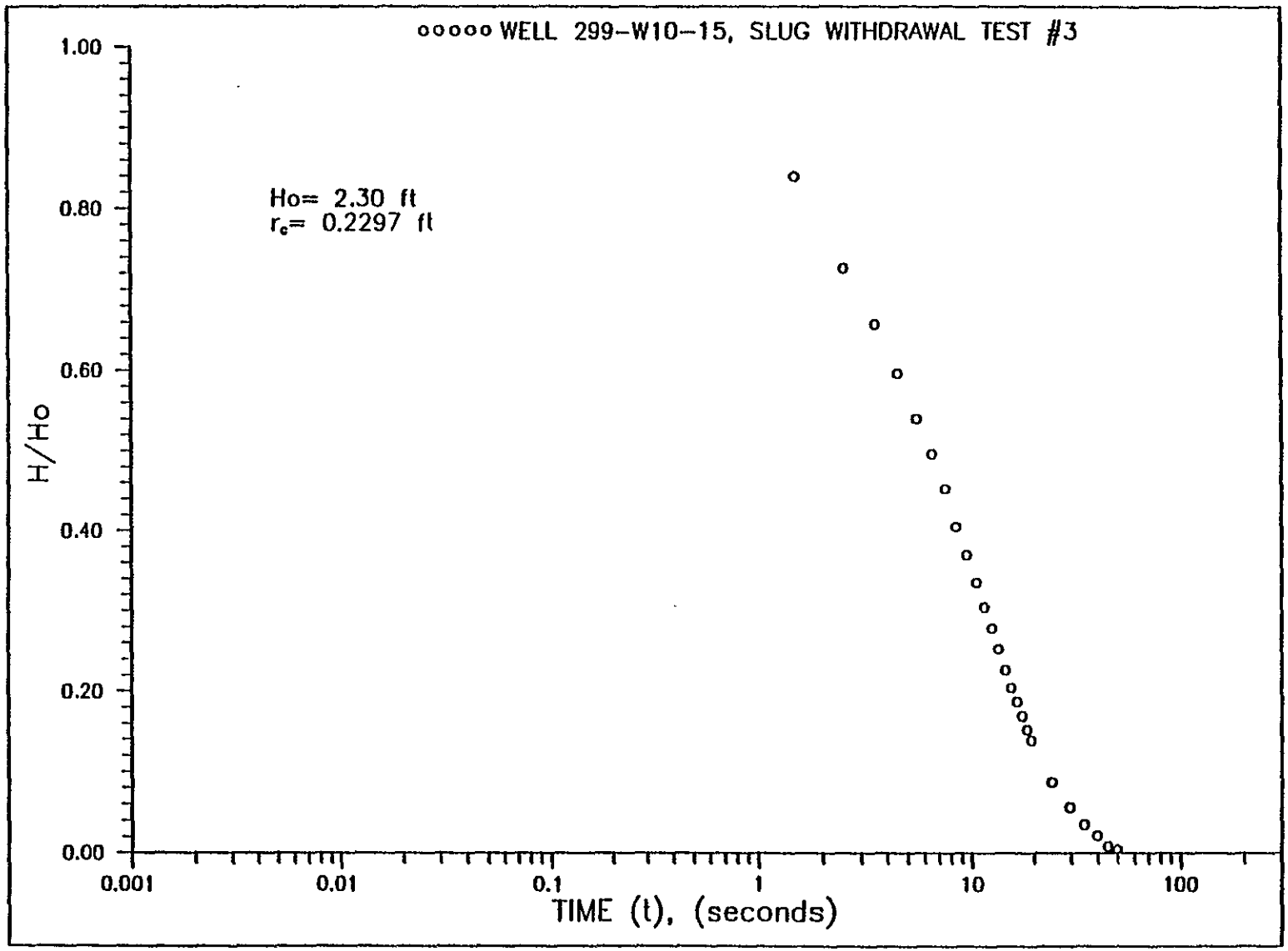
K (ft/day) = 34.2584600

****

T OF THE SATURATED SCREEN INTERVAL
(ft2/day)= 541.2836000

****

9330119.0629


ooooo WELL 299-W10-15, SLUG WITHDRAWAL TEST #3
Ho= 2.30 ft
r_c= 0.2297 ft
H/Ho
1.00
0.80
0.60
0.40
0.20
0.00
0.001
0.01
0.1
1
10
100
TIME (t), (seconds)

APPENDIX J

TEST DATA AND ANALYSIS FOR WELL 299-W10-16

9230010.1637

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APPENDIX J

TEST DATA AND ANALYSIS FOR WELL 299-W10-16

This appendix contains the as-built diagram for the well construction, Slug Test Record Form, Aquifer Test Data Sheets, Equipment Record Forms, Electronic Data Control Forms, and accompanying data logs and plots for well 299-W10-16.

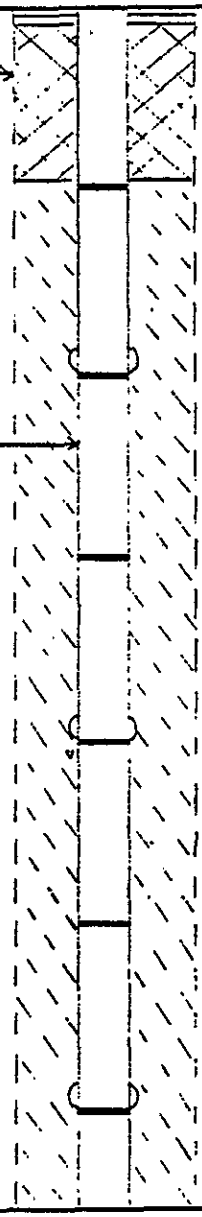
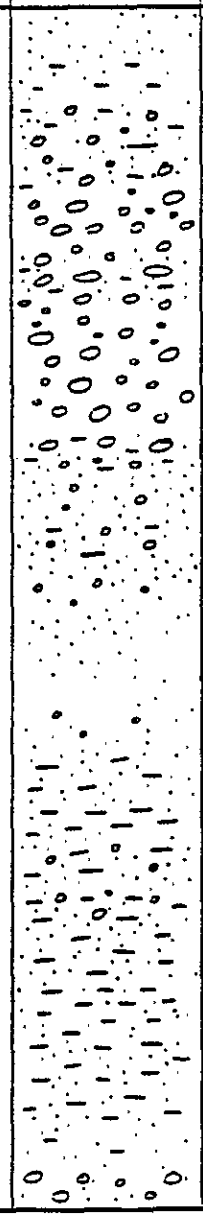
9350163.0634

Battelle
Pacific Northwest Laboratories

AS-BUILT DIAGRAM

Well Number 299-W10-16 Geologist BLEGEN, BIRCH, TEEL, BJORNSTAD, GILMORE, GOODWIN Page 1 of 2

Reviewed by [signature] Date 12-4-89

Construction Data		Depth in Feet	Geologic/Hydrologic Data	
Description	Diagram		Diagram Litho.	Lithologic Description
132'11" OF 10" CARBON STEEL CASING		5		SAND
		10		MUDDY SAND
		15		MUDDY SANDY GRAVEL
		20		" " "
		25		GRAVEL
		30		MUDDY SANDY GRAVEL
		35		GRAVEL
		40		"
200.4' OF 4" STAINLESS STEEL CASING		45		"
		50		MUDDY SANDY GRAVEL
		55		SLIGHTLY GRAVELLY SAND
		60		GRAVELLY MUDDY SAND
		65		SLIGHTLY GRAVELLY SAND
		70		SAND
		75		"
		80		SLIGHTLY GRAVELLY SAND
		85		MUDDY SAND
		90		SANDY MUD
		95		SLIGHTLY GRAVELLY MUDDY SAND
		100		GRAVELLY MUDDY SAND
		105		" " "
		110		SANDY MUD
		115		" "
		120		" "
		125		SLIGHTLY MUDDY SAND
		130		SANDY GRAVEL

A-1800-186 (3/87)

8913018.1531

Battelle
Pacific Northwest Laboratories

AS-BUILT DIAGRAM

Well Number 299-W10-16 Geologist BLEGEN, BIRCH, TEEL, BJORNSTAD, GILMORE, GOODWIN Page 2 of 2

Reviewed by D.L. McGlam Date 12-4-89

Construction Data		Depth in Feet	Geologic/Hydrologic Data	
Description	Diagram		Diagram Litho.	Lithologic Description
132'11" OF 10" CARBON STEEL CASING		135		MUDDY SANDY GRAVEL
		140		SANDY GRAVEL
		145		MUDDY SANDY GRAVEL
223'0" OF 8" CARBON STEEL CASING		150		" " "
		155		" " "
		160		SANDY GRAVEL
200.4' OF 4" STAINLESS STEEL CASING		165		" "
		170		MUDDY SANDY GRAVEL
		175		SANDY GRAVEL
		180		" "
		185		" "
		190		MUDDY SANDY GRAVEL
		195		" " "
		200		SANDY GRAVEL
21' OF 10 SLOT CONTINUOUS WRAP STAINLESS STEEL CHANNEL PACK SCREEN		205		D/W @ 202.9' 10/25/89
		210		" "
		215		" "
		219		" "
COMPLETION SYMBOLS:				DRILLED DEPTH = 219.4'
CEMENT GROUT				COMPLETION DEPTH = 219.8'
GRANULAR BENTONITE				
BENTONITE PELLETS				
SILICA SAND				
CASING JOINT				
CASING CENTRALIZER				

A-1800-186 (3/87)

Aquifer Test Data

WHC-SD-EN-TI-147, Rev. 0

page 1 of 1

Data for Well 299-W10-16
Pumping Well —
Observation Wells —

Location 200 West, T Tank Farm
Type of Aquifer Test Slug Test
How Q Measured —
How W.L.'s Measured Transducer, Steel Tape #L500-03
(Rad.) / Dist. of From Pumping Well 2"
Meas. Point for W.L.'s Top of 4" casing (1.6' a.l.s.)
Elevation of Meas. Point —

Depth of Pump/Airpipe —
Pump On: date — time —
Pump Off: date — time —
Duration of Aquifer Test —

Time t = ____ at t' = 0					Water Level Data Static Water Level 204.38' below TOC					Discharge		Recorded By	Comments
Day	Clock Time	t	t'	t/t'	Reading	Conversions or Corrections	Water Level	s or s'		Reading	Q		
10/30	1300			well	is located on south edge of T Farm access road							DRN	Set up rig
	1314				204	+ 0.38	204.38'						steel tape
	1318				D/B =	218.22' + 2.47' = 220.69'							
	1320				Set slug in place above water								datalogger IKB-700
	1325				Set up datalogger/transducer								transducer 25998
	1334				15.50'								
	1337				15.52'	Set Ref = 0	Test #2						
	1340				Drop slug (dropped slug right at log 1 cycle)								
	1355				0.06								
	1358					Stop datalogger						↓	dump data to disk
												file:	TFARM-2.SLG
	1403				15.59	Ref=0	Test #3					DRN	
	1407					Pull Slug	(just after log 1 cycle)					↓	
↓	1418					Stop datalogger						↓	dump data to disk
	1420					Removed datalogger/transducer							file: TFARM-3.SLG
10/31					Removed one bail load before setting submersible pump								
						Darrell Newcomer							10/31/89

8930210.1535

Location 2-West, T Tank Farm Date of Test 10/30/89

Well Number 299-W10-16 Procedure Number PNL-MA-567 AT-6, Rev Ø

Type of Test(s) Slug injection / withdrawal

Personnel Conducting Test D.R. Newcomer, Darrell Ludke (KEH driller)

WELL CONFIGURATION

Well Depth 219.8' bls. Borehole Diameter 8"

Well Casing Inside Diameter 4" Well Screen Inside Diameter 4"

Length of Screened Interval ~~5.0'~~ 16.4' (below water) Depth of Screen 219.3' bls - 198.3' bls

Comments Well is undeveloped

SLUG INFORMATION

Slug Construction Materials Carbon Steel

Length of Slug 6.0' Diameter of Slug 2 1/4"

Comments

Volume of Attachments (if applicable)

MEASUREMENT EQUIPMENT INFORMATION

	Make	Model	Serial Number
Electric Tape			
Steel Tape	Lufkin	Super Hi-way Nubian	L500-03
Data logger	In Situ	Hermit SE 1000B	1KB-700
Transducer	Druck	PTX-161D	259198
Other			

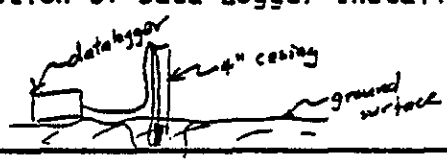
Darrell Newcomer 10/30/89

9330015.1593

Equipment Record Form for the Installation and Removal of Data Loggers and Pressure Transducers

Initial Check: OK		
Purpose of Installation: To monitor water levels during slug tests		
Monitored Hydrologic Unit or Water Body: Saturated screen interval within upper part of uppermost aquifer		
Date/Time of Installation: 10/30/89 1325 hrs.	Procedure Followed: PNL-MA-567 WL-4, Rev 0	
Data Logger Make/Model: In Situ / Hermit SE1000B		
Serial No.: 1KB-700	Number of Channels Used: 1	
Pressure Transducer Make/Model: Druck / PTX-161D	Full Scale Range: 10 psi	Well No.: 299-W10-16
	Serial No.: 259198	Depth: 219.9' below TOC (4" casing)
Pressure Transducer Make/Model:	Full Scale Range:	Well No.:
	Serial No.:	Depth:

Description of Data Logger Installation and Well Head Configuration:



Stickup of 4" casing is 1.6' above land surface

Comments: Slug was placed ~219' from top of 4" casing before dropping slug.

Equipment Installed By D.R Newcomer

Date/Time of Equipment Removal: 10/30/89 1420 hrs.

Decontamination Procedure (if required):

Equipment Removed By D.R. Newcomer

9313018.0638

(5/18/89, Rev. 0)

ELECTRONIC DATA CONTROL FORM

DATE AND START TIME OF DATA ACQUISITION 10/30/89 1340 hrs.

DATE AND END TIME OF DATA ACQUISITION 10/30/89 1358 hrs.

WELL NUMBER 299-W10-16

TYPE OF TEST OR DATA Slug Test

TYPE AND IDENTIFICATION NUMBER OF DATA LOGGER In Situ Hermit SE1000B, S/N 1KB-7000

TEST NUMBER 2

CHANNEL OR INPUT NUMBER 1

UNITS OF VALUES RECORDED ft

NUMBER OF PAGES ATTACHED 2

COMMENTS:
Test #2 = Slug injection

DATA VALIDATION STATEMENT:

The attached data represent the data as originally recorded on the data logger. Any exceptions and reasons for such are indicated in the comments section.

Darrell Newcomer, Scientist
Name, title

11/3/89
Date

8910080256

Well: 299-W10-16
Test Date: October 30, 1989
Start Time: 13:40

SE1000B
Environmental Logger
10/30 14:00

Unit# 00700 Test# 2

INPUT 1: Level (F)

Reference	0.00
Scale factor	9.99
Offset	0.01

Elapsed Time, min	Value, ft
0.0000	2.89
0.0033	1.28
0.0066	2.62
0.0099	3.50
0.0133	3.07
0.0166	2.00
0.0200	2.63
0.0233	2.73
0.0266	2.96
0.0300	2.94
0.0333	2.48
0.0500	0.85
0.0666	0.82
0.0833	0.71
0.1000	0.63
0.1166	0.57
0.1333	0.50
0.1500	0.47
0.1666	0.38
0.1833	0.35
0.2000	0.31
0.2166	0.29
0.2333	0.26
0.2500	0.24
0.2666	0.23
0.2833	0.21
0.3000	0.20
0.3166	0.18
0.3333	0.17
0.4167	0.13
0.5000	0.11
0.5833	0.10
0.6667	0.09
0.7500	0.08
0.8333	0.08
0.9167	0.08
1.0000	0.07
1.0833	0.07
1.1667	0.07
1.2500	0.07
1.3333	0.06
1.4166	0.06
1.5000	0.06
1.5833	0.06
1.6667	0.06
1.7500	0.06
1.8333	0.06
1.9167	0.06
2.0000	0.06
2.5000	0.06
3.0000	0.05
3.5000	0.05
4.0000	0.05
4.5000	0.05
5.0000	0.05
5.5000	0.05
6.0000	0.05
6.5000	0.05
7.0000	0.05
7.5000	0.05
8.0000	0.05
8.5000	0.06
9.0000	0.06
9.5000	0.06
10.0000	0.06
12.0000	0.06
14.0000	0.06
16.0000	0.06
18.0000	0.06

END

9330818.0640

(5/18/89, Rev. 0)

ELECTRONIC DATA CONTROL FORM

DATE AND START TIME OF DATA ACQUISITION 10/30/89 1407 hrs.

DATE AND END TIME OF DATA ACQUISITION 10/30/89 1417 hrs.

WELL NUMBER 299-W10-16

TYPE OF TEST OR DATA Slug Test

TYPE AND IDENTIFICATION NUMBER OF DATA LOGGER In Situ Hermit SE1000B, S/N 1KB-700

TEST NUMBER ~~1~~ DRY 3

CHANNEL OR INPUT NUMBER 1

UNITS OF VALUES RECORDED ft

NUMBER OF PAGES ATTACHED 2

COMMENTS: Test 3 = Slug withdrawal

DATA VALIDATION STATEMENT:

The attached data represent the data as originally recorded on the data logger. Any exceptions and reasons for such are indicated in the comments section.

Darrell Newcomer, Scientist — Name, title

11/3/89 — Date

9330159.1501

Well: 299-W10-16
Test Date: October 30, 1989
Start Time: 14:07

SE1000B
Environmental Logger
10/30 14:21

Unit# 00700 Test# 3

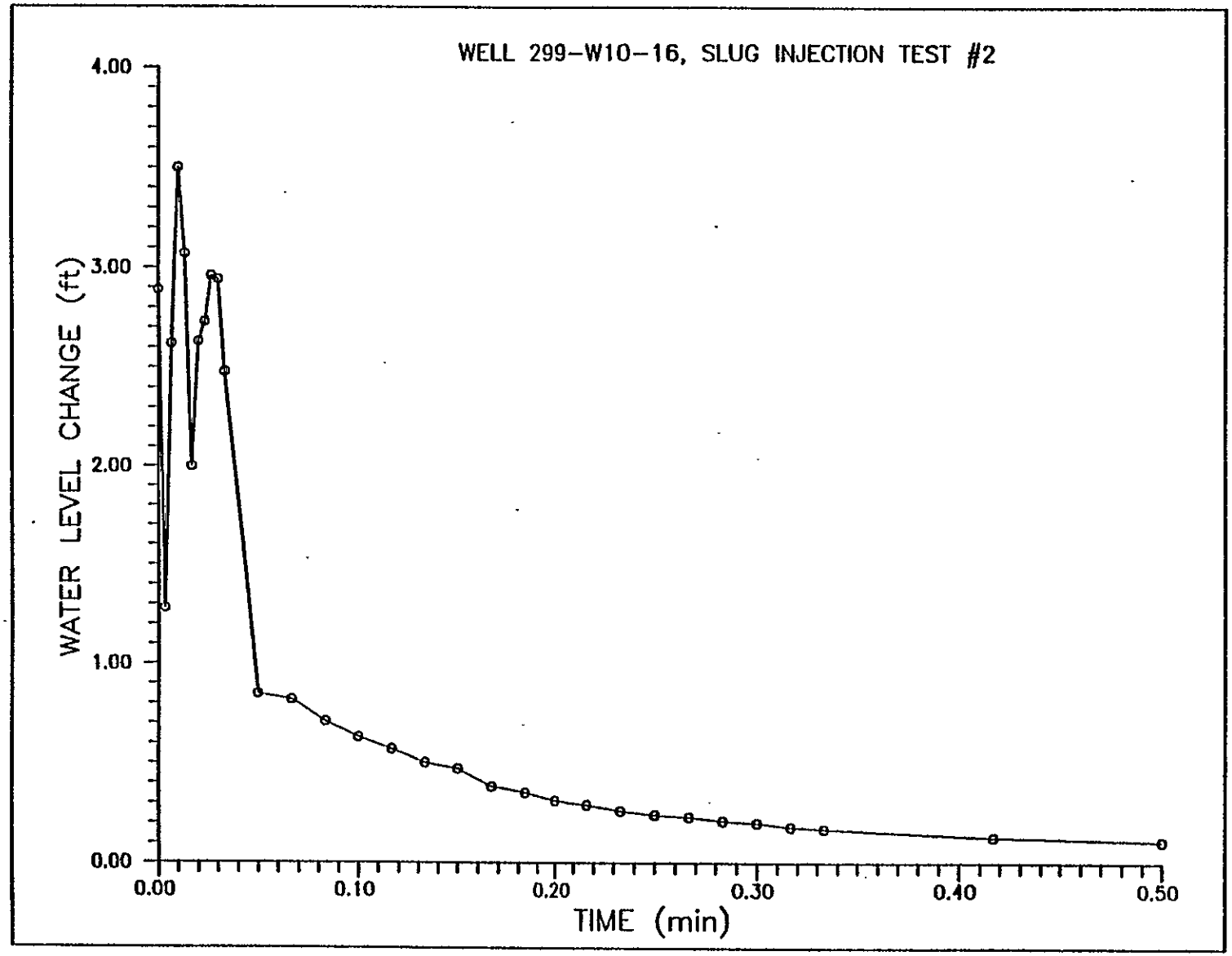
INPUT 1: Level (F)

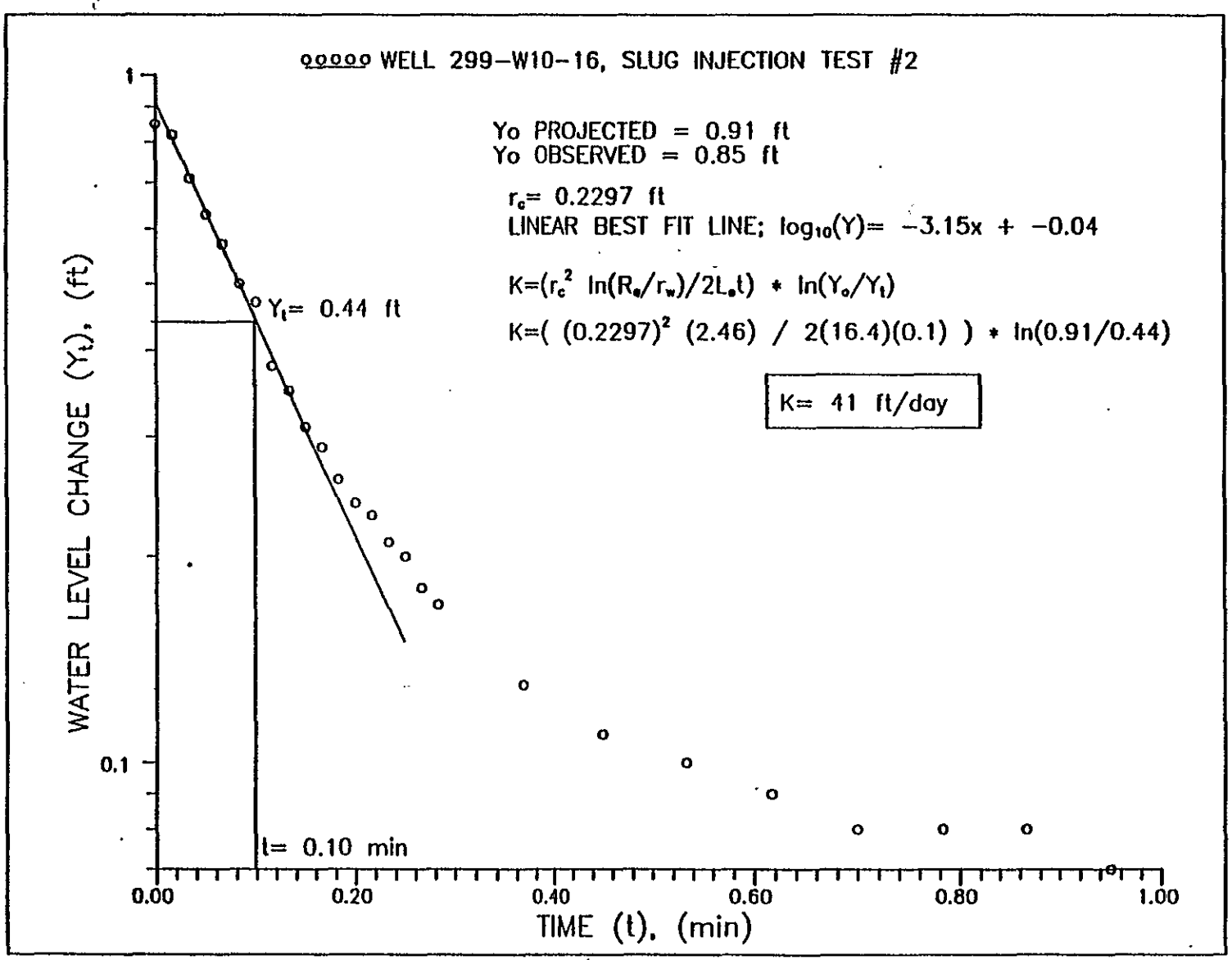
Reference	0.00
Scale factor	9.99
Offset	0.01

Elapsed Time, min	Value, ft
0.0000	0.00
0.0033	- 0.00
0.0066	- 0.00
0.0099	0.00
0.0133	- 8.46
0.0166	0.71
0.0200	0.41
0.0233	- 3.93
0.0266	- 0.11
0.0300	- 2.19
0.0333	- 0.55
0.0500	- 1.65
0.0666	- 1.61
0.0833	- 1.41
0.1000	- 1.27
0.1166	- 1.13
0.1333	- 1.02
0.1500	- 0.92
0.1666	- 0.83
0.1833	- 0.76
0.2000	- 0.69
0.2166	- 0.62
0.2333	- 0.57
0.2500	- 0.52
0.2666	- 0.47
0.2833	- 0.43
0.3000	- 0.39
0.3166	- 0.36
0.3333	- 0.33
0.4167	- 0.22
0.5000	- 0.15
0.5833	- 0.11
0.6667	- 0.07
0.7500	- 0.05
0.8333	- 0.04
0.9167	- 0.03
1.0000	- 0.02
1.0833	- 0.02
1.1667	- 0.01
1.2500	- 0.01
1.3333	- 0.01
1.4166	- 0.00
1.5000	- 0.00
1.5833	- 0.00
1.6667	- 0.00
1.7500	- 0.00
1.8333	0.00
1.9167	0.00
2.0000	0.00
2.5000	0.00
3.0000	0.00
3.5000	0.00
4.0000	0.01
4.5000	0.00
5.0000	0.01
5.5000	0.01
6.0000	0.01
6.5000	0.01
7.0000	0.00
7.5000	0.00
8.0000	0.01
8.5000	0.01
9.0000	0.01
9.5000	0.01
10.0000	0.01

END

9330B.0642


WELL 299-W10-16, SLUG INJECTION TEST #2
WATER LEVEL CHANGE (ft)
4.00
3.00
2.00
1.00
0.00
0.00
0.10
0.20
0.30
0.40
0.50
TIME (min)


WELL 299-W10-16, SLUG INJECTION TEST #2
Yo PROJECTED = 0.91 ft
Yo OBSERVED = 0.85 ft
r_c= 0.2297 ft
LINEAR BEST FIT LINE; $\log_{10}(Y)$= -3.15x + -0.04
$K=(r_c^2 \ln(R_e/r_w)/2L_e t) * \ln(Y_o/Y_t)$
$K=((0.2297)^2 (2.46) / 2(16.4)(0.1)) * \ln(0.91/0.44)$
K= 41 ft/day
Y_t= 0.44 ft
t= 0.10 min
WATER LEVEL CHANGE (Y_t), (ft)
TIME (t), (min)
1
0.1
0.00
0.20
0.40
0.60
0.80
1.00

WELL 299-W10-16, SLUG INJECTION TEST #2

THE BELOW HYDRAULIC CONDUCTIVITY VALUE WAS CALCULATED
USING THE BOUWER AND RICE SLUG TEST METHOD.
SOURCE= "THE BOUWER AND RICE SLUG TEST-AN UPDATE"
GROUND WATER, VOL 27, NO. 3, MAY-JUNE 1989.

RADIUS OF CASING USED IN CALCULATIONS HAS BEEN
CORRECTED FOR THE THICKNESS OF GRAVEL OR SAND
PACK DUE TO WATER LEVEL CHANGES IN THE SCREEN OR
OPEN INTERVAL OF WELL.

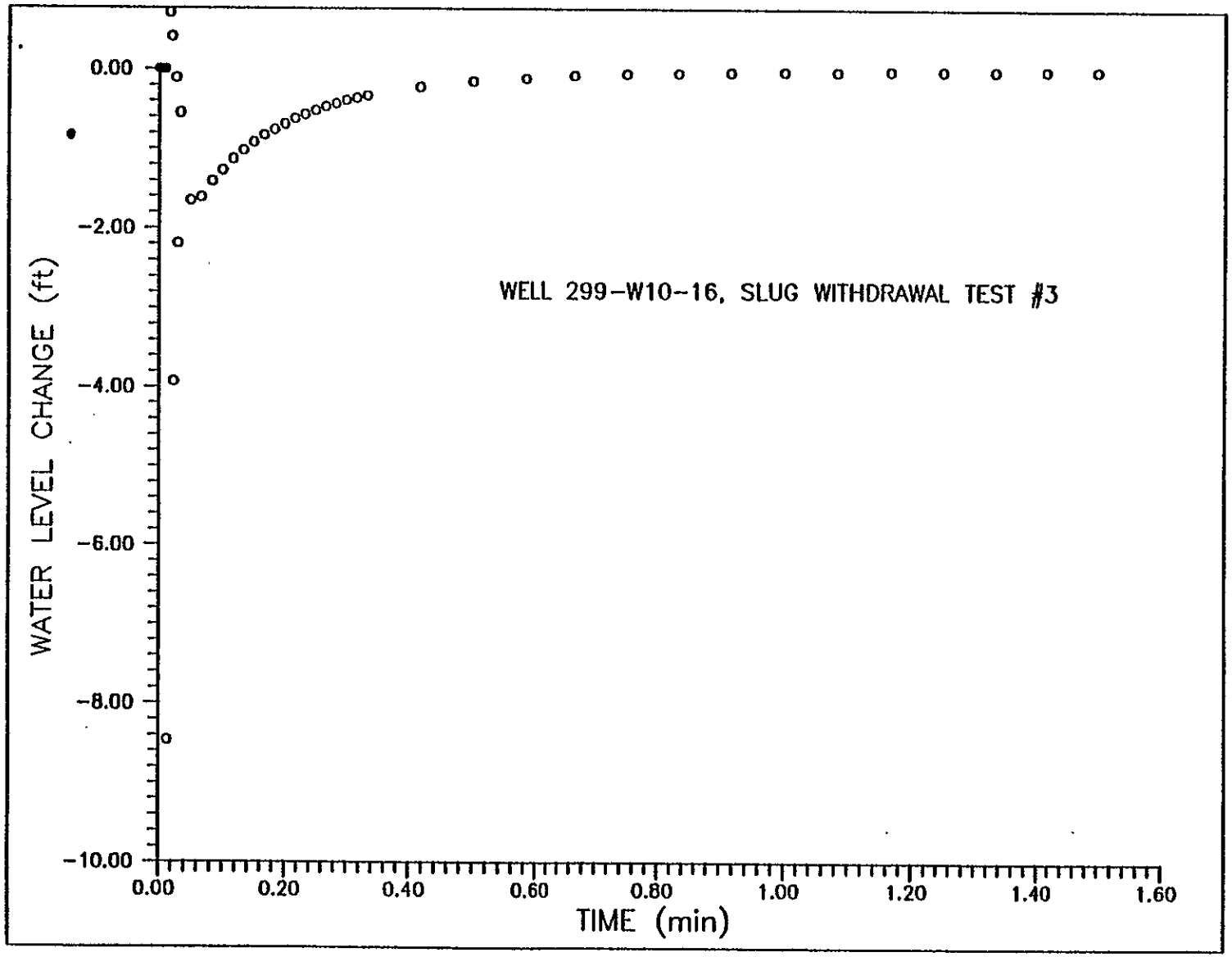
Rc (ft)	Rw (ft)	Le (ft)	Lw (ft)	H (ft)
.2297	.3333	16.4000	16.4000	275.0000

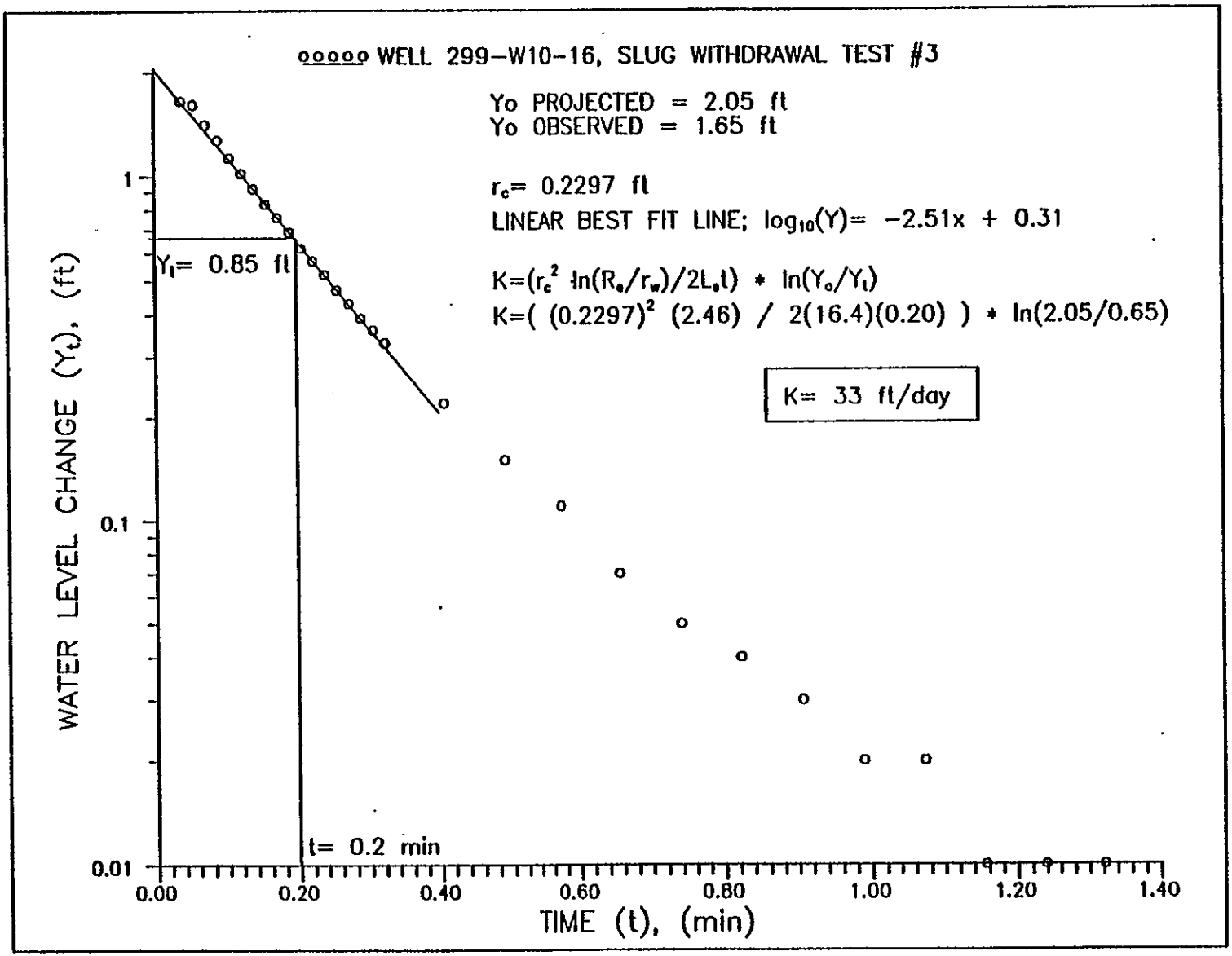
Le/Rw = 49.2000000
A= 3.0792260
B= 5.055397E-001
C= 2.6715220
SANDPACK POROSITY= 3.000000E-001
t (min)= 1.000000E-001
1/t= 10.0000000
Yo= (ft) 9.100000E-001
Yt= (ft) 4.400000E-001
1/t ln(Yo/Yt)= 7.2667000
ln[(H-Lw)/Rw]= 6.0000000
ln(Re/Rw)= 2.4595060

K (ft/day) = 41.4118800

T OF THE SATURATED SCREEN INTERVAL
(ft2/day)= 679.1549000

9330016.0545


WELL 299-W10-16, SLUG WITHDRAWAL TEST #3
WATER LEVEL CHANGE (ft)
0.00
-2.00
-4.00
-6.00
-8.00
-10.00
0.00
0.20
0.40
0.60
0.80
1.00
1.20
1.40
1.60
TIME (min)


WELL 299-W10-16, SLUG WITHDRAWAL TEST #3
Yo PROJECTED = 2.05 ft
Yo OBSERVED = 1.65 ft
r_c= 0.2297 ft
LINEAR BEST FIT LINE; $\log_{10}(Y)$= -2.51x + 0.31
$K=(r_c^2 \ln(R_e/r_w)/2L_e t) * \ln(Y_o/Y_t)$
$K=((0.2297)^2 (2.46) / 2(16.4)(0.20)) * \ln(2.05/0.65)$
K= 33 ft/day
Y_t= 0.85 ft
t= 0.2 min
WATER LEVEL CHANGE (Y_t), (ft)
TIME (t), (min)
1
0.1
0.01
0.00
0.20
0.40
0.60
0.80
1.00
1.20
1.40

WELL 299-W10-16, SLUG WITHDRAWAL TEST #3

THE BELOW HYDRAULIC CONDUCTIVITY VALUE WAS CALCULATED
USING THE BOUWER AND RICE SLUG TEST METHOD.
SOURCE= "THE BOUWER AND RICE SLUG TEST-AN UPDATE"
GROUND WATER, VOL 27, NO. 3, MAY-JUNE 1989.

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OPEN INTERVAL OF WELL.

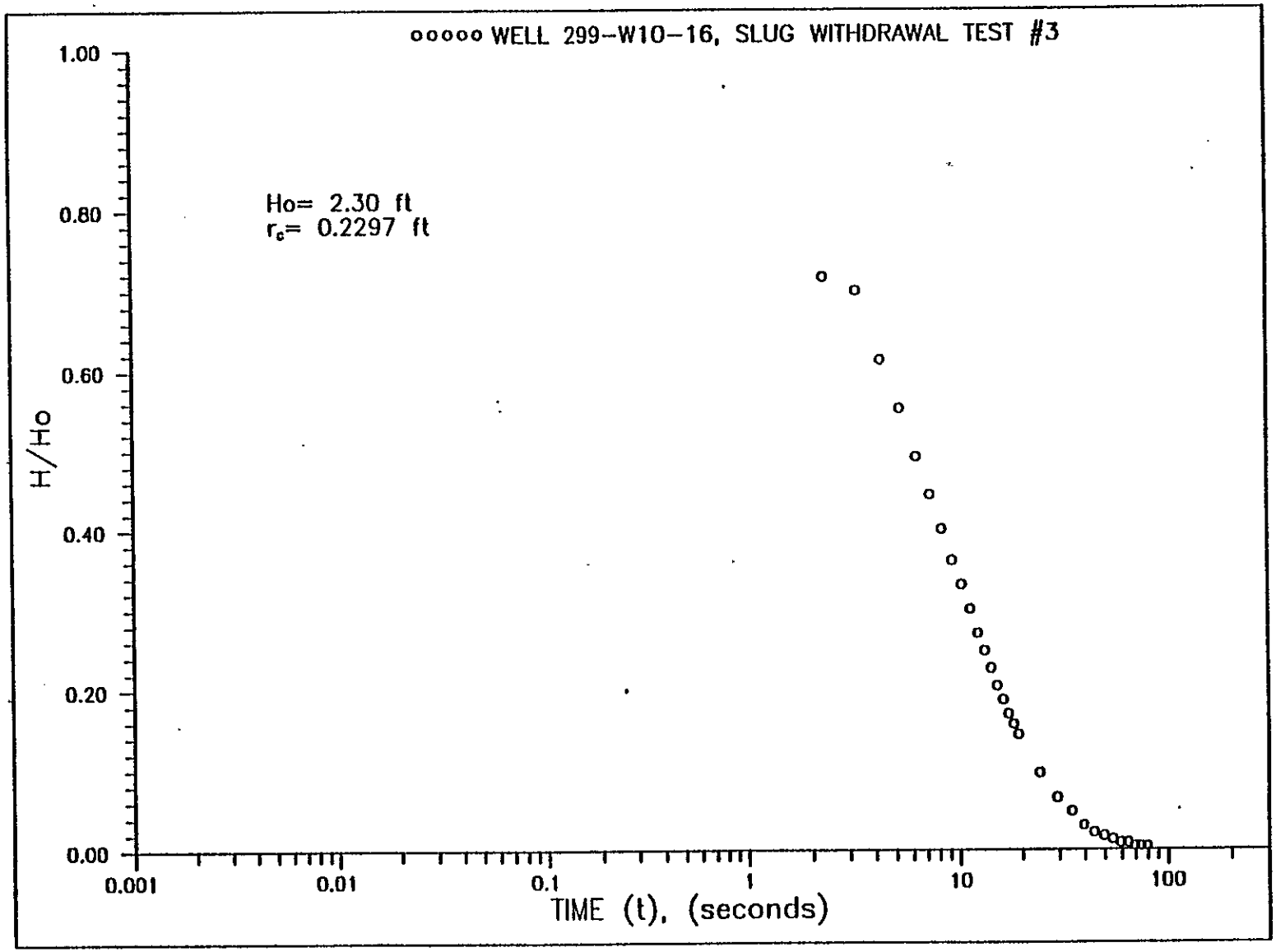
Rc (ft)	Rw (ft)	Le (ft)	Lw (ft)	H (ft)
.2297	.3333	16.4000	16.4000	275.0000

Le/Rw = 49.2000000
A= 3.0792260
B= 5.055397E-001
C= 2.6715220
SANDPACK POROSITY= 3.000000E-001
t (min)= 2.000000E-001
1/t= 5.0000000
Yo= (ft) 2.0500000
Yt= (ft) 6.500000E-001
1/t ln(Yo/Yt)= 5.7431140
ln[(H-Lw)/Rw]= 6.0000000
ln(Re/Rw)= 2.4595060

K (ft/day) = 32.7291800

T OF THE SATURATED SCREEN INTERVAL
(ft2/day)= 536.7585000

8930516.1618


ooooo WELL 299-W10-16, SLUG WITHDRAWAL TEST #3
Ho= 2.30 ft
r_c= 0.2297 ft
H/Ho
1.00
0.80
0.60
0.40
0.20
0.00
0.001
0.01
0.1
1
10
100
TIME (t), (seconds)

Date Received: 4/7/93

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Reference: WHC-CM-3-4

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List attachments.

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Date Disapproved

BD-7600-062 (08/91) WEF074

Part 1